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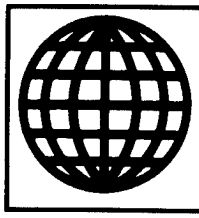

FOREIGN BROADCAST INFORMATION SERVICE

JPRS Report

Science & Technology

Europe & Latin America

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EC-Swiss Cooperation in New Materials Outlined

3698m155 Bonn TECHNOLOGIE NACHRICHTEN-MANAGEMENT INFORMATIONEN in German No 469/470, 16 Dec 87 pp 19-20

[Text] The EC and Switzerland have reached a basic agreement on scientific and technological cooperation in the area of R&D in advanced materials. The objective of the cooperation is to coordinate the European materials research program and the Swiss research program,"Materials for the Needs of Tomorrow."

The Community program for modern materials (EURAM) 86-89 includes the following areas of research:

1. Metallic Materials

1.1 Light aluminum alloys

1.2 Light magnesium alloys

1.3 Light titanium alloys

1.4 Electronic materials and electrical carbon fibers

1.5 Materials for high performance magnets

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3.3 Composite materials with a ceramic matrix

3.4 Other materials for special applications

Work is carried out as subcontracted research on the basis of sharing of costs, coordination, and training activities.

The Swiss program, "Materials for the Needs of Tomorrow" 1985-1990 [includes]:

—Materials for magnetic functions;

—Materials for surface coating of interface and processing components;

—Development of technical ceramics;

—Development of composite materials;

—Materials for electronics and opto-electronics;

—Specific polymers;

—Materials for sensors.

08617

EC Subsidizes Research on High-Performance Magnets

3698m154 Bonn TECHNOLOGIE NACHRICHTEN-MANAGEMENT INFORMATIONEN in German No 469/470, 16 Dec 87 pp 21-22

[Text] A new generation of high-performance magnets raises hopes for still unexplored potential applications in a variety of areas. At present, the expected market volume is approximately $700 million with a growth rate of 10 percent. However, only Japanese and U.S. companies have licenses.

In the opinion of the EC Commission, there is a considerable number of experts in the relevant areas of research, but the talent is scattered over the 12 member states. The work group "CEAM," subsidized by the Commission, intends to coordinate universities, industry, and research institutions in the following areas:

—Development and utilization of high performance permanent magnets on the basis of iron and rare earth metals;

—Improved cooperation and promotion of projects for applied magnetism that are relevant to industry.

—Creation of a manufacturing and information data bank that will enable industry to exploit magnets.

The EC Commission has subsidized CEAM with over DM5 million since October 1986. At present, more than 50 laboratories are concerned with projects in the three main areas of material sciences, magnets, and their applications. Among others, applications are emerging in automobile manufacturing, equipment for nuclear magnetic resonance, and particle accelerators. High performance magnets will also be used in the construction of new loudspeakers and microphones.

08617

Max Planck Institute, Bayreuth University Develop New Conductive Polyacetylene

3698m172 Bonn BMFT JOURNAL in German No 6, Dec 87 p 10

[Text] A decisive breakthrough has been made in a BMFT subsidized research product in the field of electrically conductive plastics. In cooperation with industry, the Max Planck Institute for Polymer Research in Mainz and the University of Bayreuth have developed a polyacetylene with conductive properties comparable to those of metals. This achievement proves that it is possible to replace metals with electrically conductive polymers.

These polymers should find a wide range of applications in electrical engineering and electronics, for example in the manufacture of flexible electric conductors for transmission of small volumes of energy, for electronic circuits, and for new types of electrodes.

Electrically conductive plastics have been the subject of research and devleopment for some years, particularly in the United States, Japan, and the FRG. From the very beginning, the objective of this research was to combine the advantages of plastics—particularly their light weight—with the electrical conductivity of metals, thereby opening completely new perspectives for polymeric materials. As early as the mid-1970's the Japanese researcher Shirakawa developed a polyacetylene film which, however, was not very stable. A decisive breakthrough has now been made: In projects which the BMFT financed with DM4.5 million, researchers have developed a process to manufacture highly conductive polyacetylene films at room temperature.

08706

AEROSPACE, CIVIL AVIATION

EC Comments on Nov 1987 ESA Conference

3698a155 Brussels EC PRESS RELEASE in English No IP(87) 584, 22 Dec 87 pp 1-2

[Article: "The Commission To Consider Closer Cooperation with the European Space Agency"]

[Text] A turning point for Europe's future in space was reached on 10 November in The Hague by the Ministers meeting within the Council of the European Space Agency. The Ministers approved a coherent, comprehensive plan that runs to the end of the century and has the ambitious prime objective of establishing a genuine autonomous European space capacity.

It is now time for the Community to evaluate and define how it can best contribute to the implementation of European space objectives and to the exploitation of their growing economic, political and social potential.

This is an opportunity which the Community must not pass up. By July, joint discussions between the Commission and the European Space Agency should result in a communication to the Twelve and the European Parliament on close future cooperation between the Community and the Agency.

The Community occupies a unique position as a European political institution in view of its very wide responsibilities, which range from business, trade and industry to culture and include the environment, research, technology and education.

It is not good enough for the Community to proceed on an ad hoc basis. Its activities in space (telecommunications, remote sensing, etc.) must form part of a coherent overall strategy, otherwise it will be unable to contribute fully to the worthwhile exploitation of space. This was the message given by Mr Narjes, Vice-President to the Commission, on Tuesday 22 December 1987.

Potential Areas of Cooperation

Cooperation between the Community and the ESA could extend to the following fields:

- telecommunications;

- interaction with scientific and technological programmes not related to space;

- industrial aspects: technology transfers to fields such as aeronautics or other sectors not currently related to space, the industrial repercussions of the large internal market on goods and services created by the space industry, etc.;

- remote sensing applications which would benefit in particular to Community policies on agricultural land management, the environment, regional development, fisheries, etc.;

- trade and commercial aspects associated with space operations and related goods and services;

- the problems of Community law raised by space operations. At the moment, international law does not cover certain aspects of activities in space. For example, the current ESA/NASA negotiation on the international Space Station project raises customs, taxation, property rights and technology transfer questions;

- education and training. As a high-technology sector, space operations would benefit from Community programmes such as COMETT [Community Program for Education and Teaching in the Field of Technology], ERASMUS and DELTA [Developing European Learning Through Technological Advance].

The Boom in Space Investment

The worldwide trend—the USA, USSR and Japan—is clearly towards substantial increases in investments in space, reflecting not only the "space race" but also the growing economic, social and geopolitical importance of space.

The ESA new long-term plan (1987-2000), which has just been approved, calls for a budget of 28,000 million ECU, which will increase the Agency's annual expenditure from its present level of 1,600 million ECU to about 2,600 million ECU in 1993.

By way of comparison, Europe's combined annual expenditure on space activities is 2,900 million ECU if expenditure under national programmes is added to the overall outlay of the ESA. In the USA, the level of expenditure, both civilian and military, is ten times higher and is still increasing, in particular because of the Strategic Defence Initiative programme.

Soviet investment in space is put at twice that of the USA, in other words twenty times greater than that of Europe.

At 800 million ECU, a year Japanese investment may seem modest, but it is clearly increasing rapidly and one of the aims is to create an autonomous technology base. The Japanese authorities are devising a new space programme which provides for the present level of funding to be tripled.

Even with the major increase in space funding, it recently decided the ESA will be spending only one-third of the amount to be spent by the USA during the next decade.

The Commission believes it is therefore essential for Europe to eliminate duplication of the various national programmes so as to maximize the return on its investment.

French ONERA R&D Includes Radar Cross Section, Signature Analysis

3698A132 Chatillon-sous-Bagneux ONERA ACTIVITIES 1986, SYSTEMS in English Sep 87 pp 15-24

[English version of a report published by the French National Office for Aerospace Studies and Research (ONERA)]

[Text]

Mission

The mission of the Systems Department is to conduct the pluridisciplinary studies of ONERA, in particular those involving new designs and those on aerospace systems. The work is more or less equally shared between fixed wing aircraft and helicopters, strategic missiles, tactical missiles, military systems with radar, laser or sonar vocation and, to a lesser extent, space vehicles.

This activity is carried out in collaboration with the other Scientific Departments of ONERA and can lead to tests on a significant scale in collaboration with the manufacturers and outside organizations. To support this applied research, the Systems Department also conducts its own theoretical and experimental research on aerospace mechanics, optimization, automation, aerothermics and signal processing.

Its manpower of 170, including some hundred engineers and executives, is mainly located in the Chatillon-sous-Bagneux and Chalais-Meudon centers in one Test Division and four Research Divisions focusing their activity on aerospace mechanics, thermophysics, electronic systems and optronic systems.

Means

To carry out its mission, the Department has a number of test and computation facilities classified as follows according to their vocation:

Aerospace vehicle-oriented test facilities:

—Electre launch installation

—A75 chamber

—Flight mechanics laboratory

—Rotating fluid analysis installation.

Free-fall and spin test facility, thermophysics and optronics oriented facilities:

—Pulsed photothermal material characterization facility

—Infrared thermography facility for thermophysical experiments

—High density laser impact measurement installation

—Laser sources

—Fauga-Mauzac optical installation

—SILAHR system.

Radar-oriented test facilities:

—S1 Ch radar signature analysis installation

—CAMERA anechoic chamber

—BABI bistatic radar measurement installation

—Brahms and SAW mobile stations

—SEMIRAMIS air transportable station

—RIAS experimental radar

—Radar absorbent material measurement installations.

Data processing facilities:

—These facilities are briefly described in the following pages.

Senior Staff Members

Director ..... Marcel Bismut

Assistant Director ..... Jacques Dorey

Scientific Advisor ..... Christian Marchal

Technical Advisor ..... Jacques Denis

Aerospace Mechanics ..... Jean Fave

Senior Scientist ..... Claude Aumasson

Thermophysics ..... Daniel Balageas

Electronic Systems ..... Gerard Garnier

Optronic Systems ..... Rene Jalin

Systems Experimentation ..... Jean-Claude Theodore

Electre Installation

This experimental missile launch installation is made available to ONERA by the Landes test center at Biscarrosse and is closely integrated with it. It includes a missile assembly hall, a remotely positioned launching ramp—under collapsible air conditioned shelter—a prelaunch missile command and control station and a telemetering station for initial operation. The launches can be made in a range of a few hundred kilometers in a west/northwest sector.

This installation benefits from the center infrastructure: radar and optical trajectography, safeguard, telemetering.

A75 Vacuum Chamber

This large vacuum chamber, 15 meters high and 5 meters in diameter, located in the Palaiseau Center, was built under the auspices of DEN/STEN to test a number of mechanical and pyrotechnic devices which could be used on strategic missiles, by altitude and weightlessness similarity. (Footnote) (The A75 chamber is also to be fitted with a free-fall test apparatus designed to measure the divergence time constant of spinning satellites containing liquids.)

It is therefore equipped with efficient means of recovery of free-falling bodies.

The internal pressure can be adjusted to 0.1 mb and the observation time of moving bodies in weightless state is about 1.5 seconds.

Movement of the bodies under test is filmed through specially provided windows by four Bourdereau cameras and two Photosonics cameras operating at 150 and 500 frames per second respectively. The images are then analyzed on an optical reader and restore the movement of the bodies with an instantaneous accuracy of 2 mm.

In addition to optical observation, an internal radar operating in the millimetric wavelength, located at the top of the chamber and positioned in its axis supplies a Doppler-range tomographic image of all the moving bodies.

This laboratory, located in Chatillon, is organized around a small fixed base simulator restricted to the main controls (minijoystick, throttle and rudder pedals), a Thomson INU3 synthetic display system generating twilight scenes (head-up display) displayed at a rate of 25 images per second and programmable CRTs representing the instrument panel (head-down display).

The system is connected to a SEL 32/77 computer supplemented by an AP 120B array processor operating in real time.

Rotating Liquid Analysis Installation

This installation is designed to evaluate the effect of liquids on stability of spinning satellites. It includes two turntables with accurately controlled rotation, mounted one on the other and angularly offset to simulate a sustained precession movement with adjustable characteristics.

The tank to be tested, filled to a varying degree with liquid, is rigidly assembled with the upper table by piezoelectric dynamometers whose signals provide data on the amplitude of the liquid motion and the internal viscous dissipation.

The installation operates at speeds up to 100 revolutions per minute, which subject to a careful choice of the liquid, confers satisfactory similarity conditions on the test. The sensitivity of the installation allows reproduction of a divergence time constant of 250 seconds.

Free Fall and Rotation Test Facility (CNES and ESA Contracts)

A free fall test facility is available in the A75 vacuum chamber of Palaiseau to analyze the stability of the angular movement of a small spinning body simulating a satellite containing fluid tanks. It is known that a satellite

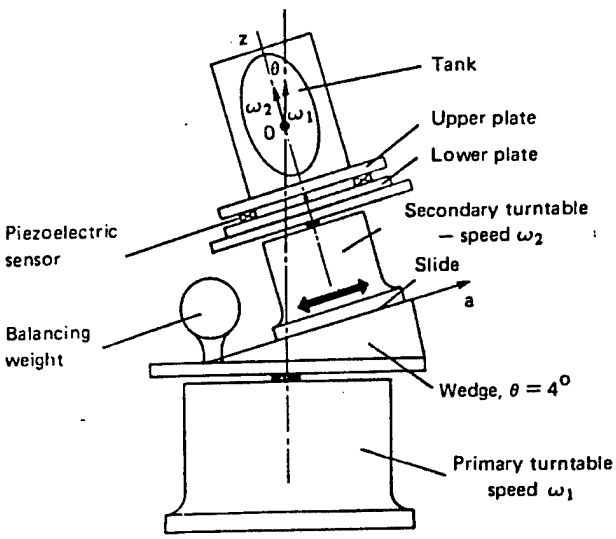


Figure 1. Rotating Liquid Analysis Installation

spinning around its axis of the smallest moment of inertia follows a conical movement whose aperture inexorably increases, mainly due to sloshing of the fluid in the tanks.

The facility can spin a 28 cm diameter model, inertially similar to the satellite studied, at high speed (2000 rpm),

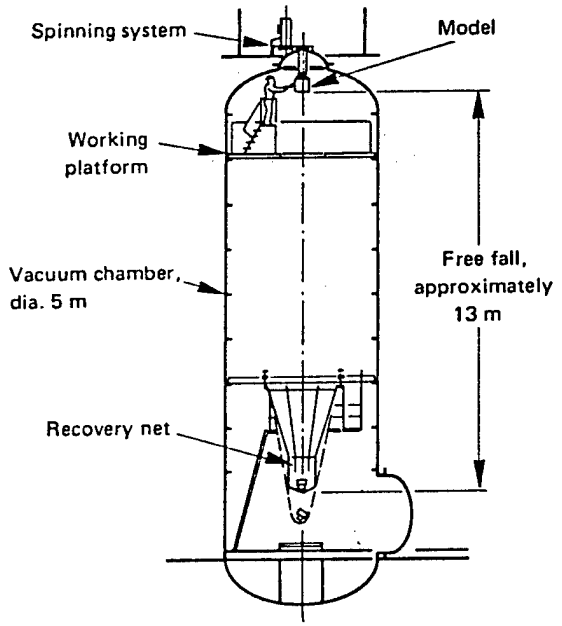


Figure 2. Cross Section of the A75 Chamber Fitted Out For Free Fall Tests

jettison this model without excessive disturbance and recover it at the end of the fall in a damping net.

The duration of free fall during which weightlessness is achieved is 1.5 seconds and is approximately equivalent to 60 seconds of flight of the satellite. Generally the test is conducted at atmospheric pressure, but it can also be conducted at reduced pressure to improve sensitivity of the measurements.

The tests are carried out on a model consisting of two modules. The first, reusable, is equipped with three accelerometers measuring the rotation speed and the nutation angle (between 0.02 and 30 degrees) and an on-board memory storing all the measurements by means of a microprocessor. The other module, which contains the fluid, can be fitted with different types of tanks to simulate a large variety of satellites.

Installation for Material Characterization by Pulsed Photothermal Method

This laboratory facility is used to measure the thermal diffusion of materials, to characterize a coating on a substrate (measurement of the effusion of the coating and the thermal resistance on the interface between the two materials), and to detect and characterize a defect in a material such as delamination in a stratified composite.

It consists of a laser operating at 0.69 micron and outputting 1j pulses in 50 ns or 350 microseconds, a mirror forming the image of the front face of the sample to be tested on an HgCdTe infrared detector cooled by liquid nitrogen and a computerized data conditioning and acquisition system.

Infrared Thermographic Installation for Thermophysical Experiments

An infrared thermographic installation is in operation in the Thermophysics Division. It includes an AGA infrared camera sensitive in the 8-12 micron band and two processing systems:

—one false color display and TV standard recording system,

—one acquisition and measurement system.

In the second system, all the images provided by the camera (25 frames a second) are stored in an instrumentation recorder during the test. The interesting images are then automatically digitized, processed by the main memory of a microcomputer and stored on a floppy disk or a hard disk.

Twenty minutes of recording, i.e. 30,000 images, can be stored by the recorder; 75 images can be simultaneously present in the main memory; 100 images can be stored on a floppy disk and 800 on a hard disk. Basic programs

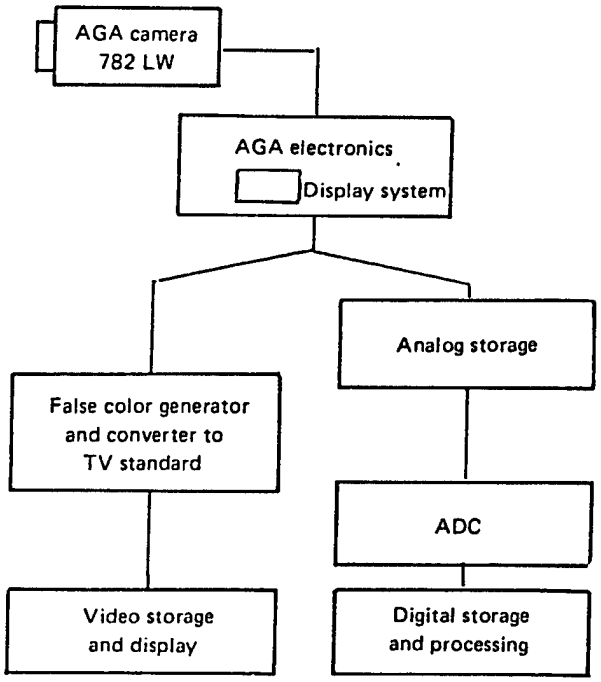


Figure 3. Infrared Display and Acquisition and Measurement System

giving the plot of contours on a line, local temperature measurements, image subtraction are operational. Other processing programs are being developed.

This system has many applications. Already, it allows research to be continued in a variety of fields such as nondestructive testing (in particular on carbon-epoxy composites), instrumentation of icing tests in the icing wind tunnel and measurement of the transfer coefficients on a model submerged in a flow at high speed.

Laser Sources

For its thermophysical experiments (laser/material interaction) and optronic experiments, the Systems Department has the following laser sources with a power above 1 W:

Fauga-Mauzac Optical Installation

This installation, now being fitted out, is designed to analyze and evaluate various optronic systems using low-energy lasers, mainly observation systems.

It includes two buildings 1,000 m apart located on flat ground covered with a variety of vegetation.

The south building is designated to accommodate most of the systems under test (transmission, reception and processing apparatus). The north building is designed to accommodate the targets observed—fixed or moving—as well as certain ancillary systems required for the experiments. The two buildings are linked by measurement and communication lines. In addition, the installation can accommodate large targets such as helicopters on external areas.

The complex is fenced and protected by natural or artificial obstacles.

SILAHR System

This active imaging concept was developed at ONERA under the auspices of DRET. The object or scene to be analyzed is scanned by a narrow IR laser beam at a rate of 100 images per second and 100 lines per image. An acousto-optical crystal deflects the beam and performs the line scanning, and a mirror performs the scanning in height. The reflected signal is analyzed in return and supplies an image in amplitude, a Doppler image—for moving objects—or a combined image by appropriate processing.

Type	Wave-length	Power or energy	Duration
CO2 CW lasers			
. SAT	10,6 μm	3 W	
. SAT C5	10,6 μm	4 W	
. SPECTRA PHYSICS	10,6 μm	5 W	
. SAT C7 (4 lasers)	10,6 μm	7 W	
. WG 08 S	10,6 μm	8 W	
. ENSTA	10,6 μm	10 W	
. CILAS 172	10,6 μm	16 W	
. CILAS 266	10,6 μm	400 W	

Other CW lasers			
. COHERENT Argon	0,5 μm	3 W	
. CILAS DF-HF	3,8 μm	20 W	
. MICRO-CONTROLE YAG	1,06 μm	70 W	

Pulsed lasers			
. BM1 neodymium	0,53 μm	25 mJ	30 ps
. J-K ruby	0,69 μm	1,5 J	50 ns

This apparatus worked on the Fauga-Mauzac optical installation over a distance of 1,000 meters.

This system, located in the large Chalais-Meudon wind tunnel which is no longer used, is designed to pick up the radar image of large targets (several meters). Four dish antennas operating in transmission and reception mode in a 2-18 GHz frequency range are located at one end of the building and illuminate the target which is suspended in the test chamber at a distance of 65 m.

The target is regularly rotated around a vertical axis (one revolution per minute) and the transmission frequency is held constant for a complete revolution but is modified from one revolution to the next. The amplitude and phase configuration of the signals reflected in the frequency band explored gives the impulse response of the target in all the attitudes observed and the location of the bright spots in the vicinity of a line of sight.

The measurement sensitivity expressed as radar cross section is 5 x 10^{-3} m^2 and the target range resolution is 7.5 cm.

"CAMERA" Anechoic Chamber

This measurement apparatus, called CAMERA (French acronym for Automatic Monostatic Radar Evaluation Anechoic Chamber) is smaller than the S1 Ch installation described above. It is located at Chatillon and is used to analyze and quantify the signature of radar targets flexibly, automatically and accurately. It can measure objects with a size of around 1 meter for all frequencies between 1 and 18 GHz and offers many possibilities for display of the results: backscattering patterns, synthesized impulse response, distance- frequency representation, 2D radar image. The spatial resolution achieved for the images is 2 cm. Radar cross sections as small as 10^{-6} m^2 can be analyzed and measured.

The LASER (French acronym for Radar Cross Section Analysis Program), used in conjunction with CAMERA, manages the input parameters, automation, filing, processing and output of the measurements as graphs and images suitable for publication. This program gives the system a high measurement sensitivity for processing times below 5 minutes.

This program was the subject of a license agreement in view of its communication to interested manufacturers.

BABI Bistatic Radar Measurement Installation

The BABI bistatic electromagnetic measurement installation placed in operation at Chalais-Meudon in 1986 is aimed at determining the radar backscattering characteristics of targets in all directions and qualifying the radar absorbent materials subjected to multiple scattering on the targets. It operates in the near field between 2 and 18 GHz and mainly includes a semicircular horizontal rail 11 meters in diameter on which move independently a microwave transmitter and receiver permanently facing the center of the circle where the target support is located. Positioning of the transmitter system, the receiver system and the target is automatic and accurate which allows the complex backscattering coefficient (amplitude and phase) of a target to be measured according to the two lines of sight of the antennas for each analysis frequency. The system is computer-controlled; the associated software provides the desired results such as:

—bistatic or monostatic impulse responses,

—bistatic or monostatic backscattering patterns,

—the electromagnetic parameters characteristic of radar absorbent materials.

Other applications of this equipment such as:

—single frequency radar imaging,

—extension of the field,

are under consideration.

Brahms and SAW Mobile Stations

To characterize the radar signature of various targets (aircraft, ships, armored vehicles) and their environment (clutter), ONERA designed and built three mobile analysis stations: Brahms I, Brahms II and SAW under the auspices of Government Agencies.

The Brahms I station, operated by ONERA for Government Agencies and manufacturers, functions coherently in the X and ku frequency bands, in CW and pulse mode, to provide either the overall target radar cross section, that of the rotating parts and that of the airframe, or a longitudinal tomography of the target (resolution 30 cm) respectively. The Brahms has a range of some 20 kilometers which can be considerably extended by the use of an original radar code called THRDD (French acronym for Very High Doppler Range Resolution).

This station was developed at ONERA under the auspices of DEN/STET to make comparative signature and background measurements in millimetric wavelengths—by active radar at 35 GHz and 94 GHz—and in passive infrared mode at 3 m and 10 m wavelengths. The originality of this measurement apparatus is that it allows measurements to be made simultaneously at the four wavelengths, thereby allowing comparison. The system is designed to be mounted on a helicopter and can also operate on the ground.

The data are measured as 2D images. In active millimetric mode (35 GHz and 94 GHz), the station outputs short pulses and cuts the received echo (impulse response) into 32 consecutive range slots with a length of 7.5 m. The transverse resolution is obtained by the

Computer	Use
MATRA MD560	Strategic missile computations
SEL 32/77 and AP 120B*	Flight simulator
CELERITY 1260 SILICON GRAPHICS I 3030 PDP 11/60	Aerothermodynamic computations
SEL 32/27 and VINIX	Optronic processing and SILAHR
MASSCOMP 5600	Adaptive optics
HP A900 HP 1000 F	Strategic radar computations
HP A900 HP 1000 F and MAP300	RIAS processing
HP 1000E	Sonar processing
HP A900	SEMIRAMIS processing
HP 1000E	S1 Ch radar installation and BABI
HP 1000 F	CAMERA anechoic chamber
HP A900 HP 1000F	BRAHMS and SAW processing
HP 1000M and FPS 5310	BRAHMS real time acquisition
HP A700	SAW on-site processing
HP A900	Guidance - Control computations
AD MACSYM 260	A75 chamber operation and processing

* Minicomputers shared with the Computer Science Department.

directive of the antennas. In infrared mode, the resolution is achieved by the narrow field of view of the associated optics and elevation in scanning is achieved by a small vibrating mirror.

For the entire system, transverse exploration is achieved in flight by the movement of the helicopter itself (lateral aiming) and on the ground by an angular rotation of the station driven by a motor. In this case, the entire process is under the control of a minicomputer which controls movements of the motor, performs digital acquisition and processing of the various signals and displays the resulting images in real time on a color CRT.

RIAS Experimental Radar

This experimental radar with dispersed antennas is designed to test validity of an original air surveillance concept. With 25 transmitters and 25 receivers distributed on a quasi-circle 400 m in diameter, it can simultaneously perform a surveillance function while tracking several separate targets, through suitable coding of the transmitters and sophisticated processing of the signals returned. The real-time processing associated with the surveillance and tracking functions is planned to be carried out on a digital computer under development. At the same time, implementation of the surveillance function on an optical computer is being studied.

Radar Absorbent Material Measurement Installations

Two measurement installations are available to determine the complex permeability and permittivity of various materials from small samples.

They operate on the principle of mismatching of a waveguide obstructed by the material in the plane of a straight section of the guide. Measurement of the reflection and transmission coefficients of these lines in which an electromagnetic wave is propagated in a known mode provides data for computation of the electromagnetic constants.

The first measurement installation includes a rectangular waveguide operating in the 8-12 GHz frequency range; the second is a microribbon operated between 100

MHz and 1 GHz. These two apparatuses are controlled by a computer which corrects the errors intrinsic to waveguides and gives a measurement accuracy of a few percent for the first installation and 10 percent for the second.

Computer Facilities

In addition to the 16 terminals assigned to it and connected to the central computer facilities of ONERA, the Systems Department has the minicomputers listed below. They are either assigned to specialized systems as processing units or used as independent computers.

25046/06662

ESA Director, FRG Research Minister Outline Aerospace Strategy

3698m164 Duesseldorf VDI NACHRICHTEN in German No 50, 11 Dec 87 p 17

[Article by Susanne Paech: "Catching Up Will Not Be an Easy Task;" Space Technology As a Step Toward European Unity; Equal Rights Are to be Strived For; Research Minister Heinz Riesenhuber has promised to keep costs under control; first paragraph is VDI-N introduction]

[Text] Munich 11 Dec (VDI-N)—The fact that the "Second European Conference on Space," organized by the European student organization EGEE (Etats Generaux des Etudiants de l'Europe) on "The European Potential for the Creation of Independent Space Transport Systems," took place just 10 days after the European Council of Ministers' decision on a long-term European Space Program, was a mere coincidence.

Yet it gave the conference's distinguished participants—including Research Minister Heinz Riesenhuber and ESA General Director Reimar Luest—good opportunity to indulge in an euphoric atmosphere, created by the outcome of the council meeting in The Hague and indicative of how relieved they were.

Reimar Luest, who basically agreed with the substance of Riesenhuber's statements, pointed out that the compromise reached by the Council was mainly due to the diplomatic skills and repeated conciliatory efforts of Riesenhuber who had presided over the particularly controversial and intense debate. In his main speech at the conference, the research minister pointed out that the time had come "for individual projects to become part of a European-wide strategy for large space systems," with a view toward promoting European autonomy in that sector. Riesenhuber also stressed the "unifying potential" space technology has for Europe, to which all the interested parties could contribute and gain from. He spoke of "great common objectives" and "great efforts," expressing his confidence that outstanding problems will be solved.

Nevertheless, both Riesenhuber and Luest agreed that autonomy and partnership are not to be regarded as alternatives, and stressed their opposition to such polarization. According to Luest, autonomy means having technical competence and does not mean excluding cooperation. "A partnership is meaningful, possible, or balanced, only if the partners are strong and able to provide their own contribution, unless they are able to act independently and achieve something on their own. A good partnership cannot be based on the mere willingness to please, but must be the result of strength and determination," emphasized Research Minister Riesenhuber in an impressive tone, leaning his right arm on the desk and pointing his left forefinger in a warning attitude.

Strength and determination are two qualities that the American partners do not like very much. In fact, they are highly concerned about Europe's sudden desire to have its opinion. The consequences of the "American concern" for the Attached Pressurized Module (APM), which is the European contribution to the space station and better known as Columbus, cannot yet be predicted. According to experts, if negotiations failed, not only would the development of the APM program be canceled, but planned shuttle missions with spacelab, as envisaged by the D2-Mission, would also come to a halt. However, these are essential if Europe—as planned—is to start working immediately on the Man Tended Free Flyer (MTFF), the essential part of an autonomous European space station without APM.

This raises another problem, which only rarely comes under public discussion. It is not simply a question of developing and constructing a space system. A large infrastructure is required on the ground for them to become operational. In the case of the APM and MTFF, despite strong Italian protests they will be built partly by the European space control center in Darmstadt and partly by the DFVLR's [German Esperimental Institute for Aeronautics and Astronautics] space control center in Oberpfaffenhofen, and it will be developed based on the know-how deriving from D1 and future manned missions. Neither cost nor operational requirements of the ground infrastructure have yet been precisely assessed. The problem of infrastructure is even more serious with the European space glider Hermes. Even the best transport system is useless unless it can be operated. However, Europe is far from having the know-how necessary to operate a manned space vehicle. Technical competence can be obtained rapidly with a high investment, or it could be developed gradually with great delays, in order to achieve the high safety standards that are required for manned space missions.

Minister Riesenhuber said that the best solution was to continue to learn. At what price? And with what benefit? Even the research minister could not provide a satisfactory answer. Manned space missions are undoubtedly a source of international prestige, despite the absence of short-term commercial or scientific advantages. Besides,

the "unifying potential" of space technology for Europe must also be taken into account. The question is not so much whether Europe can afford to finance manned space missions—the European Community spends even larger sums on much more questionable transactions, of which agricultural subsidies are only the most striking example. However, it should not be forgotten that manned space missions over an indefinite timeframe would absorb most of the resources devoted to the research budget. Therefore, once made, such a difficult decision would be virtually irreversible.

The European research ministers have once again gained time with their decision. Minister Riesenhuber promised "to do his best to stay within the estimated cost and the timetable," adding that as a general rule large-scale projects should not exceed their original cost estimates. Yet, some experts do not think that this will be possible in the case of Columbus and Hermes. Hopefully the research minister will still remember his statement in 3 years.

08802

Italian Space Plans Include Remote Sensing, Data Analysis

Space Plan Director's Report

3698M176 Turin MEDIA DUEMILA in Italian
No 10, Nov 87 pp 32-37

[Interview with Luciano Guerriero, physics professor at the University of Bari and director of the Italian Space Plan; date and place not specified]

[Text] "The Italian Space Plan (PSN) is moving ahead after last year's 2-year program update for the 1987-91 period. We felt some shockwaves from the interruption in launches after the Shuttle Challenger tragedy and the pause in Ariane flights, but luckily the consequences were not serious. In fact, in some cases these delays gave us a breathing space for our complex programs." This is how Prof Luciano Guerriero, physics professor at the University of Bari and director of the Italian Space Plan [PSN] describes the national space program. Between 1987 and 1989, approximately 1.2 trillion lire are scheduled to be spent, meaning that more than 2 trillion [lire] will be spent in the 5-year period to 1991.

Guerriero explains: "The government has flexible 5-year planning cycles and this is the best way to stay attuned to the international situation in terms of program changes and new economic considerations."

"Although the program is an industrial one, there are very close ties with universities. The National Research Council (CNR) acts as the link between scientists and industry in identifying which programs to carry out, the scope of these programs, and the developments expected. Both the government and politicians are increasingly well disposed to space programs. This can be seen from the increasingly large allocations [to the space program]: in 1987 the allocation totaled 400 billion [lire] and should stay at approximately this level for the next few years. The CNR has been delegated by CIPE [Interministerial Committee for Economic Planning] to coordinate Italian activity in the sector under the supervision of the Ministry of Scientific Research."

"The program breakdown into specific items shows that more than 50 percent (51 percent to be precise) will be spent on program applications, including telecommunications and propulsion. Almost 30 percent will go to scientific programs (17 percent for scientific satellites and 12 percent on pure and applied research) with these two elements closely related to each other.

Scientific satellites are important because they are at the frontiers of human knowledge, including technological knowledge, and therefore are subjected to risks that program applications do not have to face."

Thus the Italian Space Program deals with all the sectors connected with this new type of activity. One of these, of great interest for practical applications that can be used almost immediately, is [represented by] environmental monitoring, or remote surveying, for which the PSN is setting aside 9.1 percent of the resources allocated under the 5-year plan. "Remote surveying, "Guerriero explains, "is being handled in a very broad way, in three general areas: sensor development, the development of instruments for data analysis, and pilot project development."

"In connection with sensors, there is a very ambitious joint project with the FRG to develop X-SAR radar, that is, synthetic-aperture X-band radar, around 10 GHz. Selenia Spazio and Dornier are working on this bilateral cooperation project. The device will be put into orbit in 1991 onboard a shuttle, together with American devices produced by JPL in various frequency bands. This will be a multispectrum mission with active microwaves that can see through clouds and observe the ocean and land that has emerged, in order to see objects and identify them using an alternative method to that of optical instruments, which are not effective when there is cloud cover. This survey method can be used for forests, agriculture, problems involving the physical identification of ocean conditions, glaciers, surface objects, and wind conditions that can be deduced from ocean conditions. We believe that this is the future of remote surveying, and for this reason we are engaged in an international program to develop a polar platform for the Columbus program."

In addition to the SAR-X, we are developing a passive microwave scanning radar to study the ocean surface (temperatures, etc.), and we are also evaluating research on other high-definition instruments for the polar platforms, such as interferometers, in visible and infrared radiation."

The second development area involves instruments for analyzing the remote-survey data. Guerriero continues: "To ogranize data processing, we are heavily involved in Telespazio's and Selenia Elsag's SAR-processing project, with a special-purpose computer based on the AMMA computer. This [project] is at a very advanced stage and will form the basis for processing of the data sent from the SAR-X and the ERS-1 [European Relay Satellite] active microwave satellite. We need extremely advanced graphics/picture systems for the processing of data from remote surveys if we are to have highly competitive Italian products because, while there is only one satellite there are many customers, and it would hardly be very advantageous if we had to turn to the international marketplace for these devices. We think in terms of the users, in order to develop an Italian product with good processing capabilities."

Last, there is development of pilot projects. Prof Guerriero explains that "[Pilot projects] help us to understand the way in which the data from satellites have to be integrated with the information from airplanes and from the ground in order to understand the phenomena to which the data relate, such as the oceans, melting snow, or geological features. Launching the program is an original initiative. The task of the Italian Space Plan's pilot structure is to supply intermediate data, integrated from various sources, which will be easy for the customer to use and from which he or she can extract the most useful elements for his or her needs. For example, data on the temperature of the ocean surface and on wind conditions are gathered not just from one satellite but from a number of sources, and the customer is interested in knowing the intermediate physical data. The objective of the pilot project is to understand which intermediate physical data can be of greatest use to users.

At a later stage, the various areas of application could deal with the specific problem, which at this point is no longer a space problem, because space merely provides the [relevant] information."

Guerriero then moves to another application area, that of telecommunications; 30.2 percent of the allocations are scheduled to be spent on this area between now and 1991. "This is the PSN's most important program and it goes back to the immense success of Sirio, which was launched 10 years ago and which supplied us with valuable information." The major commitment in this sector is the Italsat program. According to Guerriero, "This is the leading edge in our industrial sector and perhaps the most advanced system in the world, including ground stations and their operation." Still in the telecommunications area, "The Monomic project is moving ahead. This is intended to develop monolithic gallium arsenide electronics for satellite receivers. Although we decided not to develop monolithic integrated circuits, various components have been developed for the complex antenna system (from the antenna to the switching [smistamento] in the domestic television set. All this has been done in the interests of the Italian audience for live satellite television."

The earth can be surveyed from space and here Guerriero opens up the vast area of space geodesy. "Everything began in 1977 with NASA's placing in orbit of the Lageos 1 satellite, at a distance of 5,000 km in space, to obtain extremely precise measurements. The satellite is a simple ball covered with mirrors that reflect laser rays; its position is identified precisely, because we have been following it for 10 years. Under the space geodesy program, there is a station at Matera with installations currently being developed. This is in a strategic position: last year the international geodesy campaign in the Mediterranean area used Matera as its reference point. The laser ranging installation is already fully operational; this is used to transmit laser rays to the satellite and to measure their return. This year a large antenna 22 meters in diameter will be set up to receive radio signals coming from remote galaxies. In addition to being used for radioastronomy, it will study the movements of the earth's crust, using the stars as "radio lighthouses." Matera is the reference point for the mobile laser stations that Italian industry is constructing and which, together with GPS-type systems, may be used to track landslides. The fact that Italy has this capability, which will become part of an international network, represents another success for the country's space program. The space geodesy program is scheduled to launch the Italian-built Lageos 2 satellite by 1991, perhaps with the same shuttle mission used for the STS (the Space Tethered Satellite). Leaving the shuttle, the satellite will reach its definitive height at 6,000 km above the earth; an Italian motor will be responsible for all these maneuvers."

Guerriero concludes by discussing the overall situation of the PSN. "The National Research Council has played a very important role in an extremely unusual situation, because the PSN started as a temporary commitment [for the CNR], but after a few months, the CNR had to take over responsibility for the planning and management of PSN activities, with all the decisions that this involves. An important structure was created in which management tasks are kept separate from production responsibilities—the only example of its kind in Italy. People are highly qualified in various areas and perform management tasks only, as should always be the case. However, there is a very serious problem; all the specialists were hired under 5-year nonrenewable contracts, in accordance with the regulations for the parastatal sector, and as things stand now, unless a decision is made to establish an Italian space agency, or permanent positions at the CNR are found to manage this whole program, we are in danger of losing these specialists." Thus Guerriero concludes that "While we wait for parliament to decide to create such an agency, two things are necessary to keep moving ahead: first, the stabilization of the organizational structures, giving personnel a certain degree of tranquility, because some contracts have already expired, and second, to place all Italian space activity under the technical/scientific management

of one organization. The space department of the Ministry for Research handles management of the ESA [European Space Agency] component, while the CNR handles the Italian part. Even with the best cooperation in the world, these are separate organizational structures. Therefore, the CNR should take over technical responsibility for European activities, leaving the political side to the ministry."

Satellite Mapping Projects

3698M176 Turin MEDIA DUEMILA in Italian No 11, Dec 87 pp 38-39

[Article by Cesare Protetty: "Help from the Sky for Cartography"]

Table 1. QUADRO RIASSUNTIVO DEGLI IMPEGNI DEL PIANO SPAZIALE NAZIONALE (miliardi di lire)

Progr. (1)	Fasi (2)	(3)	Totale progr.	(4) Fino al 1987	1987	1988	1989	1990	1991	Totale 1987-1991
	(5) Totale in corso		1.912,32	747,66	358,81	319,45	194,38	172,10	128,00	1.164,66
	(6) Totale continuaz.		172,50	0,00	4,00	19,50	42,00	62,00	45,00	172,50
	(7) Totale nuovi prog.		259,50	0,00	9,00	45,00	70,50	65,00	70,00	259,50
	(8) Totale tutto		2.344,33	747,66	371,81	383,95	306,80	299,10	235,00	1.596,66
Italsat	(9) Segmento spaziale		410,83	235,16	120,08	50,59	0,00	5,00	0,00	175,67
	(10) Segmento di terra		57,00	10,00	21,00	16,00	10,00	–	–	47,00
	(11) Lanciatore lancio		116,89	19,37	33,50	56,52	7,50	0,00	0,00	97,52
Italsat II	(12) Anticipo parti		30,00	0,00	6,00	24,00	–	–	–	30,00
Olympus/Ital.	(13) Esperimentazione		18,46	0,00	5,70	2,76	2,00	4,00	4,00	18,46
Tethered	Segmento spaziale		124,83	68,83	24,00	24,00	8,00	0,00	0,00	56,00
	Core equipment		25,40	11,70	13,70	0,00	0,00	0,00	0,00	13,70
Iris	Segmento spaziale		166,77	131,16	28,63	6,98	0,00	0,00	0,00	35,61
Lageos	Segmento spaziale		25,50	25,50	–	–	–	–	–	0,00
Iris/Lageos	(14) Operaz. lancio		10,00	2,00	2,00	4,00	2,00	–	–	8,00
Sax	Segmento spaziale		178,43	12,63	16,00	44,80	59,00	46,00	0,00	165,80
	Segmento di terra		19,53	2,23	3,00	3,00	7,00	4,30	0,00	17,30
(15)	Lanciatore lancio		45,00	0,00	3,50	2,50	7,00	13,00	19,00	45,00
Propulsione	(16) Endor. + Criog.		49,42	2,42	8,00	10,00	16,00	9,00	4,00	47,00
Oss. terra	(18) Telerilevamento		98,45	28,85	17,30	15,30	7,00	13,00	17,00	69,60
(7)	(19) Geodesia spaziale		36,25	13,75	7,00	4,00	3,50	4,00	4,00	22,50
Ricerca base	(20)		149,98	49,98	10,90	15,50	19,80	27,80	26,00	100,00
Ric. tecnolog.	(21)		74,40	26,40	6,00	6,00	12,00	12,00	12,00	48,00
Studi e sviluppi	(22) Per attiv. future	(23)	73,41	13,41	12,00	12,00	12,00	12,00	12,00	60,00
Operazioni	(24)		76,05	22,55	10,50	10,50	10,50	11,00	11,00	53,50
Formazione	(25) Specialisti	(26)	9,00	0,00	1,00	2,00	2,00	2,00	2,00	9,00
Sirio			5,64	5,64	–	–	–	–	–	0,00
Cra	S. Marco D/L		20,00	20,00	–	–	–	–	–	0,00
Gestione	(27) Struttura Psn/Cnr	(28)	36,93	11,93	5,00	5,00	5,00	5,00	5,00	25,00
Supporto	(29) Assistenza tecnica	(30)	29,40	9,40	4,00	4,00	4,00	4,00	4,00	20,00
Anticipazioni	(31)		24,75	24,75	–	–	–	–	–	0,00
Continuaz.	(32) Tether Cont. + Demo	(33)	88,00	–	2,00	6,00	20,00	30,00	30,00	88,00
	Sir-D		45,00	–	–	5,00	10,00	20,00	10,00	45,00
	Utiliz. Sar-X + Ers-1	(34)	10,00	–	2,00	2,00	2,00	2,00	2,00	10,00
	Iris II + Motore	(35)	29,50	–	–	6,50	10,00	10,00	3,00	29,50
Italsat II	Sec. Unità di volo	(36)	45,00	–	2,00	13,00	20,00	10,00	–	45,00
	Lancio	(37)	0,00	–	–	–	–	–	–	0,00
	Nuovi Payload Tlc	(38)	35,00	–	1,00	4,00	10,00	10,00	10,00	35,00
Sviluppo	(39) Nuovi sottos. S/C	(40)	35,00	–	1,00	4,00	10,00	10,00	10,00	35,00
Space station			0,00	–	–	–	–	–	–	0,00
	Logistic system		60,00	–	2,00	10,00	13,00	15,00	20,00	60,00
	Polar Platf. Sar-X	(41)	42,00	–	–	2,00	10,00	10,00	20,00	42,00
	Utilizz. Columbus	(42)	28,00	–	1,00	2,00	5,00	10,00	10,00	28,00
	Prep. Refuel + Ammu	(43)	14,50	–	2,00	10,00	2,50	–	–	14,50

Table 1—Breakdown of Italian Space Plan Commitments (in billions of lire)

Key:
1. Program
2. Phases
3. Total program
4. Up to 1987
5. Total programs underway
6. Total continuing programs
7. Total new programs
8. Overall total
9. Space segment
10. Ground segment
11. Rocket launching
12. Advance payment of parts
13. Tests
14. Launching operations
15. Propulsion
16. Rocket propellant plus cryogenic propellant
17. Earth monitoring
18. Remote survey
19. Space geodesy
20. Basic research
21. Technological research
22. Research and Developemnt
23. For future activities
24. Operations
25. Training
26. Specialists
27. Administrative costs
28. PSN & CNR structures
29. Administrative support
30. Technical assistance
31. Advance payments
32. Continuing programs
33. Continuation Tether program plus demonstration model
34. SAR-X plus ERS-1 operations
35. Iris II plus engine
36. Second flight unit
37. Launching
38. New telecommunications payloads
39. Development
40. New S/C subsystems
41. SAR-X Polar platform
42. Columbus operation
43. Refueling and ammunition preparations

[Text] Cartography has entered a new era with the advent of satellites. It would not be an exaggeration to say that with the information and imagery supplied by satellites, geodesy has made a leap forward in quality and completeness compared to the recent past. Over the last few years, the improved image quality and the superior geometric resolution (the most modern satellites achieve 10 meters of resolution) have made it possible to produce medium-scale maps, up to 1:100,000 in the case of the Thematic Mapper (TM), and even 1:50,000 in the case of the French satellite Spot.

The Thematic Mapper of the Landsat 4 and 5 satellites is a sensor capable of gathering data in seven bands: blue, green, red, close to the infrared bnad, two bands in the intermediate infrared band, and thermal infrared. Every object on the ground has its "spectral signature" and therefore can be identified by the TM; for example, vegetation reflects primarily green light and infrared, with very little red and blue light. More specialized sensors, like those to be installed on the ERS-1 satellite to be launched in 1989 can make use of active microwave technology, which is more reliable and precise than that employed by the optical instruments available today, given that it is not affected by weather conditions or by the time at which the observation is made.

A new area of research and application has been identified by the Italian Institute of Military Geography, which has entrusted the consortium formed by CISET and ACS (Advanced Computer Systems) with the task of superimposing conventional cartographic data on telematic imagery and of producing high-precision maps with the images obtained from remote surveying: 15 meters in the case of the Landsat Thematic Mapper and 5-10 meters in the case of Spot.

This work has made it possible to perform two major tasks: the production of thematic maps and the updating of basic medium- and small-scale maps. By comparing satellite images against existing maps, it is easy to identify cases in which the territorial structure has altered to such an extent that updating of maps is required: [for example,] cities which have grown much larger, incorporating suburbs, new highways, or changes in the routes followed by roads.

This constant updating of maps is essential if we are to be able to deal with problems involving development and the environment on the basis of reliable and recent information: [for example,] for adopting regional development plans and urban plans; for an evaluation of the impact and the possible damage from major disasters; environmentally damaging phenomena; and the environmental consequences of human activities.

Land management officials from all the regions of Italy took a serious look at the problem of standardizing and improving Italian map production during the Interregional Cartography Conference organized 1 year ago by the International Center for Coordination and Documentation of Land Data.

Three proposals were made on this occasion. The first was to ask the government and parliament to adopt a plan to complete, within 4 years, the maps of areas of Italian territory currently unavailable (approximately 20 percent). The second was for a serious analysis of the data needed to produce maps that can be used to plan urban developments, industrial constructions and electricity stations, and to take a fine arts inventory. The

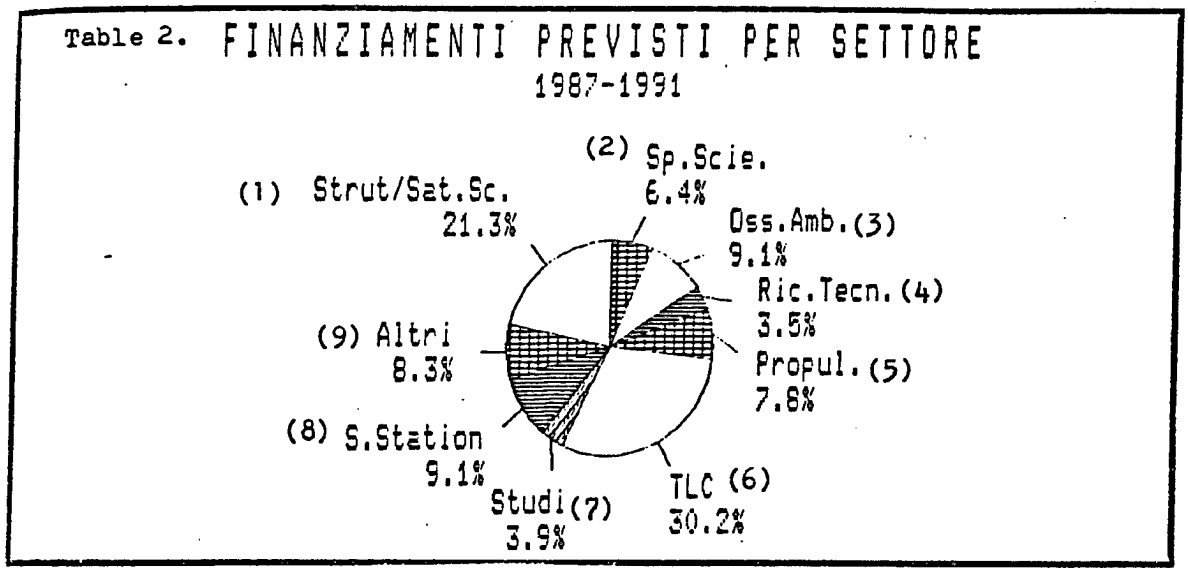


Table 2—Estimated Financing by Sector

Key:
1. Structures scientific satellites
2. Scientific specializations
3. Environmental monitoring
4. Technological research
5. Propulsion
6. Telecommunications
7. Research
8. Space station
9. Other

third proposal was aimed at the production of cartographic instruments to support national and regional standardization efforts to safeguard the environment.

A good example of this cartography of the future is that developed by Arc-Info, a company in the IRI [Institute for the Reconstruction of Industry]-Stet Group. Arc-Info (this is also the name of the territorial information database produced by the same firm) processes and displays the results of cartographic, thematic, and descriptive data, thus making it possible [to create] a series of simulations of the effects of possible changes in the environment.

8615/9738

BIOTECHNOLOGY

Italy's Research Ministry Creates Biotechnology Research Company

3698m140 Rome GAZZETTA UFFICIALE DELLA REPUBBLICA ITALIANA in Italian
No 279, 28 Nov 87 p 20

[Text of decree of the Italian Ministry for the Coordination of Science and Technology Research Initiatives on the establishment of the Tecnogen biotechnology research company in Pomezia; issued in Rome on 7 November 1987]

[Text] On the basis of Article 4 of law no 1089 of 25 October 1968; On the basis of law no 652 of 14 October 1974; On the basis of Articles 10 and 29 of law no 675 of 12 August 1977; On the basis of law no 46 of 17 February 1982; On the basis of law no 910 of 22 December 1986 (1987 finance law); On the basis of the decisions of CIPI [Interministerial Committee for the Coordination of Industrial Policy] issued on 25 January and 11 June 1979, on 22 December 1982, and on 8 August 1984; On the basis of the regulations of the scientific and technical committee referred to in Article 7 of law no 46/1982; On the basis of the agreement between the Treasury Minister and the Italian Institute for Financing Personal and Real Property [IMI]; On the basis of his own decrees issued on 23 January and 8 May 1987 concerning distribution of the funds for 1987 according to the interventions required; On the basis of the proposal of the aforementioned scientific and technical committee;

Hereby decides the following:

Articles of Incorporation

The research company "Tecnogen S.p.A." (large company classification) with registered offices at Pomezia (Rome) is incorporated.

Company activity: biotechnology research (ref. no 49358).

Form of financing: the issue of shares.

Maximum amount: 1.5 billion lire equal to 30 percent of the capital of the company being incorporated, estimated at 5 billion lire (share for large companies/south of Italy).

Special clauses: creation of operational structures, each one including research laboratories, and with at least one located in the south of Italy, involving fixed investments for a sum of at least 50 percent of the company capital and with timely hiring of an appropriate number of employees, in order to ensure that autonomous company operation can be begun rapidly; promotion and implementation of programs for training researchers and highly qualified personnel who will be responsible for increasing research, production, and development in the sector of advanced biotechnologies in line with the intervention scheduled under the National Research Program; programs, projects, and research in the enviornmental sector and the agro-industry, preferably to be carried out in the operational structures located in the south of Italy; launching of initiatives and programs aimed at creating a technology transfer to small and medium-sized companies, and to encourage new industrial initiatives with a high technological content, with particular reference to the south of Italy.

In connection with the above conditions, methods of implementation and appropriate methods of operational verification will be defined in order to optimize the launching of the initiatives within a maximum timeframe of 2 years from the date of this decision.

Copies of this decision will be forwarded to the Treasury Ministry (DGT), to the CIPI secretariat, and to IMI; the text of this decision will be published in the Italian Official Gazette.

Rome, 7 November 1987, [signed] Minister Ruberti

08616

COMPUTERS

EC, France, FRG Take Steps to Protect Computer Security, Design

EEC's Major Computer Security Programs

3698A095 Le Chesnay BULLETIN DE LIAISON DE LA RECHERCHE EN INFORMATIQUE ET EN AUTOMATIQUE in French Sep-Oct 87 pp 2-5

[Article by Andre Grissonnanche, consultant at XP Conseil, leader of the MAP 1009B and 1009D projects, and president of Teletrust: "Security Research of Europe's Information Systems: Account of the Actions of the Commission of the European Communities During the Past Decade"]

[Excerpt] The recommendations from these various studies have been largely followed, and the Commission of the European Communities has committed itself to pursuing these projects, which is reflected today in projects undertaken within the framework of various common programs:

- the multiyear data processing research program,
- the COST [European Cooperation in Scientific and Technological Research] program,
- ESPRIT [Europen Strategic Program for Research in Information Technologies].

The following paragraphs outline the essentials of these projects.

The Multiyear Data Processing Research Program

In November 1984 the Council of the European Communities once again decided to allocate a major part of its financial support to research within the multiyear program on the security and confidentiality of data. The council endorsed the recommendations of previous reports and retained eight subjects from those proposed in their conclusions. A call for proposals published in the OFFICIAL JOURNAL OF THE EUROPEAN COMMUNITIES on 13 August 1985 received 30 proposals, 7 of which were ultimately retained:

- Network security (two studies),
- Software integrity,
- User awareness,
- Security for small- and medium-sized systems,
- European users' data protection guide,
- Vulnerability of the information society.

These various studies which were started in mid-1986 should be finished between June and December 1987. The total budget allocated by the European Commission, which was 50 percent of the total research budget, amounted to 1 billion ECU's.

The Data Processing Agency [ADI] was the prime contractor for two specific studies:

- Network security, with the National Computing Center (NCC, Manchester, UK), the National Software Center (NSC, Dublin, Ireland), and Elektronik-Centrale (EC, Copenhagen, Denmark),
- Software integrity, with the NCC (Manchester) and EC (Copenhagen).

These two studies account for a total budget of 240,000 ECU's, 50 percent of which are financed by the EEC.

The main objectives of these two projects are:

- to identify the need for user protection in specific fields,
- to establish state-of-the-art protection methods, techniques, and products and to determine their operational efficiency,
- to propose programs and actions to increase user awareness and competence in planned applications,
- to propose subsequent initiatives to be taken by the

Commission, particularly in new product development.

These two studies should be finished in September 1987.

With the decision to close down the Data Processing Agency, the French contracts related to these studies were transferred to an information and organization advisory company, called XP Conseil, which the project leader designate, Andre Grissonnanche, joined.

Among the other projects, many have been awarded to advisory companies operating in various European countries in close cooperation with the major international audit and advisory agencies: Coopers and Lybrand, Deloitte Haskins and Sells, Arthur Young.

The COST Program

The topic of systems and data processing security is also present in the COST program for scientific and technical research coordination. This project, although managed by the EC Commission, is still open to non-member states (e.g., Sweden, Finland, Yugoslavia) and was extended for the third time in 1985.

The COST II Ter [third part] program, dedicated to remote data processing research, follows COST II Bis [second part], which in turn succeeded the COST II program, which launched the EURONET network. The principle of this program, the last projects of which are to be finished in 1987, is to finance research organizations in their effort to establish cooperation with other European organizations: The actual research cost is borne by each organization at a national level.

Two projects involving security were supported by the COST II Ter program during the 1985-1987 period:

Security Mechanisms in Data Processing Networks

This project, coordinated by Mr Sead Muftic from the Sarajevo (Yugoslavia) IRIS-Energoinvest Institute, aims to provide:

- both a comprehensive view and original proposals for security architectures within the OSI [Open Systems Interconnection] model,
- existing state-of-the-art protection mechanisms in the OSI context,
- proposals for protection devices that are best suited to overall network protection.

Teletrust

This project previously called OSIS and currently headed by Andre Grissonnanche/XP Conseil (France), aims at:

- proposing a universal system of electronic signature and message authentification, using a cypher-based algorithm with public keys (actually RSA [read signal amplifier]),
- studying user requirements for authentification in networks,
- studying standardization requirements for authentification in networks, making as many proposals as possible, and acting in cooperation with international standardization institutes (ISO [International Standards Organization], CCITT [International Consultative Committee on Telegraph and Telephone]),
- studying judicial problems related to the identification of the correspondent as proof of transactions in these networks.

Seven countries are currently involved in the project: France, the FRG, Italy, the UK, Sweden, Finland, and Ireland; Spain could join next; and three international institutions are members of the group: INTAMIC (International Association for the Microcircuit Card), the European Savings Banks Group, and SWIFT (Society for Worldwide Interbanks Funds Transfer).

To date, electronic signature systems are the subject of technical proposals, and experiments are being conducted. In order to continue the project and the enhanced effective cooperation, those involved have decided to found a European consortium beyond the COST program, called Teletrust International, which will be created in 1988 as an international association under Belgian law.

Mandis

System and network security matters are also being developed within other COST projects, particularly in the Mandis project, which aims at the development of methods—and one model in particular—as well as tools to ensure permanent control of network activity, in particular to trace any overload, error, or failure and to return the system to full operating mode as soon as possible.

The ESPRIT Program

Up to now, strangely enough, the major effort by the EC Commission in information systems security described above did not have the expected ESPRIT follow-up.

Only one ESPRIT project is concerned with security, particularly in the field of office automation systems. This project actually covers four ESPRIT topics:

- workstation security,
- communications security,
- very high-security systems,
- systems security.

The project participants are:

- in France, the Bertin Company and Protexarms,
- in Denmark, Christian Rowsing,

- in the UK, the University of East Anglia.

The project's aims are defined as follows:

- to establish state-of-the-art protection devices in the field of physical and logical security and in office automation systems' integrity protection,
- to implement innovative proposals to better satisfy the future security needs of office automation systems users,
- to establish the foundations for European standardization in office automation systems security, as well as in the assessment of the security of existing systems.

The project has been divided into three stages, each having a specific aim:

- the development of a technical state-of-the-art,
- the development of a security model for office automation systems in a hostile environment,
- the preparation of a synthesis and formulation of proposals and recommendations.

The project should be completed in early 1988.

Conclusion

Through this presentation, we intended to emphasize the importance of the European Commission's effort in the field of information systems security.

Our account is of course incomplete, and we would like to ask all those whom we forgot to mention to forgive us. Furthermore, we must emphasize that many Community initiatives, although not directly aimed at information systems security, still contribute indirectly to the progress of this topic on a technical level and to a better grasp on the practical level. This is also undeniably true for projects currently under way within the Commission to automate document transfer in international trade. All these projects cover the entire security field, including very technical topics, as seen up to now, and topics, equally important, involving risk analysis, investment choices, and user awareness.

We have shown how research subjects developed in the past decade from preoccupations with the protection of individual data to more modern topics aimed at improving end user training and awareness for example. We can testify that this evolution largely corresponds with the user companies' expectations and that the Commission's effort is vital in a field where general interest and the novelty of the subject largely justify public support as well as international coordination of projects.

25024

New FRG Law Protects Chip, Mask Design

36980137b Duesseldorf VDI NACHRICHTEN in German 4 Dec 87 p 24

[Article by Dr of Engineering Ralph Schippan, employed with the Duesseldorf Patent Attorneys' Bureau of Cohausz & Florack: "Microchips Can Be Protected From Being Imitated"]

[Excerpts] Since last month, it has been possible in the FRG to protect the geometric structures of a semiconductor product against wrongful copying and exploitation by third parties. In contrast to corresponding regulations in the United States, through this semiconductor protection law not only are chips to be secure from copying, but also it is going to be possible to protect the corresponding layouts and production masks. Thus, this proprietary right is of interest not only to semiconductor producers, but also above all to small and medium-sized businesses that have themselves designed a microchip tailored specifically to their own applications or have had such a chip designed by others.

The Law on the Protection of Topographies of Microelectronic Semiconductor Products, the Semiconductor Protection Law (HalbSchG), took effect in the FRG as of 1 November. The new proprietary right can be acquired for the FRG by nationals of EEC states who have a domiciliation in the EEC region. Thus it represents an investment protection for a piece of work performed in the region of the EEC.

One goal of the new law is to create an industrial proprietary right for topography—that is, the three-dimensional structure of a microchip. In contrast to technical proprietary rights such as patents or registered designs, it is just the geometric design of the microchip alone that is protected, and not the way it mechanically functions or the technological process used in manufacturing it!

The object of protection (Article 1, Paragraph 1) can be first of all the topography of the microchip itself, and thus the geometric structure of the separate layers of the chip.

Secondly, it can also be the masks that are used for making the microchip.

But thirdly, the objects of protection can also be independently utilizable parts of such layers or masks. These include, for example, gate arrays—that is, standardized functional units that can be adapted to the corresponding application through suitable circuitry interconnections—mostly executed by the user himself.

Aside from the masks themselves, also other types of representation of the chip design can be protected, such as plots or microfiches. Here, not only the final form but also each intermediate form of a semiconductor product can be covered by such protection.

A prerequisite for the protection of a topography (according to Article 1, Paragraph 1, Sentence 1) is that this must show an "originality." In this connection it is presupposed (according to Article 1, Paragraph 2) that the topography itself is the result of intellectual labor and not the simple copying of somebody else's topography. Moreover, the concept of "originality" implies that the topography must not be commonplace— that is, must not merely conform to the standard common in the semiconductor industry.

Protection of Industrial Secrecy a Problem

On the other hand, "novelty" in the patent-law sense is not a prerequisite for topography protection. The independent creation of an already existing topography and above all the further development of a semiconductor product on the basis of an analysis of a protected topography (so-called "reverse engineering") is viewed as permissible. Also the capability of receiving protection does not require a personal intellectual creation or a measure going beyond the knowledge of an average specialist in accordance with the provisions of the copyright law ("level of achievement") or the patent law ("creative activity"). Whereas usually in the case of rights to the protection of intellectual property the proprietary right is basically vested in the creator or inventor of the protected work, in topography protection what is dominant is the need for the protection of the rights of the party that makes large capital expenditures for the development or the designing of microchips (Article 2). Therefore when a topographic product has been created within an employment relationship the protection is vested in the employer, and in the case of a contract of manufacture it is vested in the respective contract orderer (Article 2, Paragraph 2). If at the same time the topography is an invention in the sense of the patent law or has a level of achievement within the meaning of the copyright law, in addition to the topography protection also patent or copyright protection is possible. Then regarding the right to the topography the corresponding regulations of the copyright law or the patent law in conjunction with the employee inventor law are applicable.

The proprietary right for microchips originates via a filing with the German Patent Office. Thus what is involved here is a right to registration (Article 3). The fee for this is DM 500 for each topography. Annual fees are not charged. With this filing, according to Article 3, Paragraph 2, a registration application is to be submitted, which must contain the data for identifying the applicant and the description of the topography, as well as documentation for identifying or illustrating the topography.

As for documentation, what is meant primarily are drawings or photographs of the topography to be protected, for example layouts, masks/partial masks, or other imagings of layers of the microchip. Then in supplementation of this, data storage media or printouts of these or the chip itself as well as its functional description can also be submitted as well for the sake of an explanatory description.

Since what is involved is strictly a registration right, no substantive-law checking of the application is done by the German Patent Office, for example with respect to the presence of an originality condition or of the truth of the alleged facts. What is checked is only whether it pertains to a topography at all and, if so, whether one or more are involved. Likewise the documentation is checked to see whether on the basis of statements by the applicant a business secret is involved. Furthermore the question is also relevant as to when the first not merely confidential business exploitation has taken place, since a protection is possible only when this exploitation happened no more than 2 years previously. The applicant must furnish the proof of this. The first not merely confidential exploitation corresponds roughly to the point in time at which the chip manufacturer has made its first specific offering to interested outsider parties.

Since what we have here is a registration right, the procedural provisions of the new semiconductor law are closely modeled on the provisions of the registered-designs law in its new version. This is especially true also of the cancellation procedure (Article 8).

A special problem arises as to the protection of industrial or business secrets in connection with the inspection of records that is to be made available to the general public. For the keeping of such secrets the option given here is firstly to make up an original copy that contains the topography to be protected in a fully identifiable form and submit it exclusively for the purpose of inspection of records in cancellation or authenticity proceedings and infringement proceedings, and secondly to submit for the general inspection of records a second copy with defaced portions that are to be protected as an industrial secret (Article 4, Paragraph 3). But here limits are placed on the public inspection of records that is otherwise the normal practice in the protection of industrial rights, inasmuch as this may be done only "firsthand"—that is, for example by way of a personal viewing at the German Patent Office.

According to Article 5, the period of protection of the topography begins either on the day of the first not merely confidential business exploitation of the topography, if this has not happened more than 2 years previously, or—if no exploitation has yet commenced—on the day of application with the German Patent Office. If in the latter case the application still has deficiencies, then the protection begins when the deficiencies in the application have been rectified (Article 3, Paragraph 3).

The protection of the topography ends with the passing of the 10th calendar year following the year of beginning of protection.

One peculiarity of this semiconductor protection compared to the other special proprietary rights found in legal protection for industry lies in the fact that this protection can no longer be claimed if more than 15 years have passed since the day of the first recording of the topography and the date of filing the application or else the day of the first not merely confidential business exploitation. This produces a legal unambiguity for competitors with respect to the possible existence of a proprietary right.

The protective effect of topography protection relates to the fact that every third party is prohibited from copying and exploiting the topography—that is, from offering, marketing, circulating, and introducing this topography. On the other hand, it is not forbidden to possess, use, or take advantage of a protected topography for one's own purposes. But also copying for the purpose of analysis, evaluation, or instruction is permissible, as is the independent creation of an already existing topography. This exception is restricted only by the general ban on business exploitation (Article 6, Paragraph 3). A copied topography that has no additional "originality" compared to the protected original must not be exploited. But if a third party uses the information obtained from a knowledge of the protected topography in such a way that the topography thereby further developed by him has an originality on its own part, then he is not affected by the proprietary right (Article 6, Paragraph 2, Point 3, "reverse engineering").

Good-faith Acquirers Exempted from the Protective Effect

Finally, the semiconductor law has a provision for the bona-fide acquisition of a microchip that contains a protected topography. The good-faith acquirer is exempted from the protective effect of the exploitation ban if he did not know or could not know that it covers a protected topography (Article 6, Paragraph 3). However, in such a case the acquirer has to pay to the party entitled a compensation if he undertakes a business exploitation after he has gained knowledge of the proprietary right or has negligently not gained such knowledge.

The reasons for this provision can be seen in the fact that the validity of the topography proprietary right is more or less difficult to search out in comparison to other industrial proprietary rights. Only the announcement of the entry of the topography in the patent notice gives the third party an indication of the existence of the proprietary right, whereas he is given no indication of a proprietary right from anything in the period of time before this, which can last as long as 2 years. Microchips acquired in good faith can be exploited by the third party, if they cannot help being known to him, only in return for a reasonable compensation, for example at the level of the customary licensing fee.

The "Ordinance on Filing Topographies of Microelectronic Semiconductor Products" as well as the "Notice to the Filer of Topographies of Microelectronic Semiconductor Products" are available at the German Patent Office.

12114

French Laws Protect Chip Design, Computer Security

Origins of Law

36980129 Paris ZERO UN INFORMATIQUE in French 23 Nov 87 pp 33-34

[Article by Christine Peressini: "A Patchwork Law"]

[Excerpts] Whether by referring to common law or by adopting special documents, computer law and the law for new communication technologies is slowly taking shape whenever traditional legal interpretations are not appropriate.

Interdisciplinary in nature, computer law attempts to cover—with some inevitable delays—the very rapid evolution of new technologies.

Ten years after the first law specific to this field, known as Computers and Freedoms, established by CNIL , the national commission of the same name responsible for watching that the implementation of computerized files does not infringe on individual freedoms, Parliament is on the verge of adopting a document on computer fraud. This is the Godfrain law proposal whose provisions are meant to be incorporated into our penal code.

Because software piracy is one aspect of computer fraud, a first step has in fact already been taken with the 3 July 1985 document which in particular, has awarded programs the protection extended to creative work by authors' rights.

Illegal program copying can henceforth be punished with penalties as severe as two years of prison and 120,000 francs in fines.

However, some of these provisions are now placed in question by the recent university pirating affair, which various computer associations has already addressed, and by the practice of confiscating counterfeit copies.

Essence of Computer Law Formed By Law Covering Computer Contracts

At the beginning of this month, the legal arsenal was also bolstered with a document on the protection of semiconductor chips. The national law came in response to a European directive and to reciprocity agreements with the United States.

At the same time, telecommunications law, born with the 1982 Fillioud Law on audiovisual communication, is now based on the 1986 Leotard Law, which has superseded its predecessor.

Slightly apart from this, the 24 September regulation on value-added networks—known as computer networks open to third parties—which use specialized connections, is ultimately intended to become the application decree for the future law on telecommunication competition, which is currently in preparation.

Summary of Chip Design Law

36980129 Paris ZERO UN INFORMATIQUE in French 23 Nov 8 7 p 34

[Article by Bernard Colas: "France Joins the 'Club'"]

[Excerpts] The Senate and the National Assembly have unanimously adopted the law proposal on the protection of semiconductor product topographies, and on the organization of the National Institute for Industrial Property (INPI). Given the urgency and magnitude of the stakes, the draft law created very little debate. Internationally, France had to honor the date of 7 November 1987, established by the directive of the December 1986 Council of the European Communities, to implement the provisions regarding the protection of semiconductor product topographies.

FRG, the Netherlands, and Great Britain are expected in turn to adopt a law, as did the other EEC member countries. Japan, Switzerland, Sweden, and Australia, all claim to satisfy American requirements.

The French law, published in the JOURNAL OFFICIEL of 5 November 1987, will become effective after adoption of the application decree, which will define the registration procedure clauses. Briefly, this law intends to protect any designer who is a national of, resides in, or is established in an EEC member state. This protection lasts a period of ten years following the registration date of a final or intermediate topography for a semiconductor product, or the date of first commercial utilization, if the latter is previous to the former.

It should be noted that only topographies which reflect an intellectual effort on the designer's part, and which are not common in the industry, can be the object of the registration established with the director of the National Institute for Industrial Property (INPI). The protection entails prohibition for any third party to reproduce, import, or make commercial use of the protected topography.

This exclusive right is subject to some exceptions. It is in fact permitted to reproduce a protected topography without its owner's authorization, for the purpose of evaluation, analysis, or teaching. Moreover, a good-faith third party who buys a protected topography, will have to pay a fair indemnity if he intends to undertake commercial utilization of the acquired product.

During the Senate debate of 22 October 1 987, it was stipulated that the invention of an employee who is performing his functions, belongs to his employer.

Articles of Chip Design Law

36980129 Paris ZERO UN INFORMATIQUE in French 23 Nov 87 p 33

[Law of 4 November 1987]

[Text] Title I of the Law of 4 November 1987

Article 1. The final or intermediate topography of a semiconductor product, reflecting an intellectual effort on the designer' s part, can be the object of a registration that confers the protection provided by the present law, unless the topography is commonly known.

However, this registration cannot occur, either more than two years after the topography was first used commercially anywhere at all, or more than 15 years after it was established or coded for the first time, if it was never used.

Any registration which is not consistent with the conditions stipulated in the present article, is null and void. Article 2. (i) The registration right belongs to the designer or his assignee.

If a registration was performed in violation of the rights of the designer or his assignee, the injured party can claim ownership. Claim action is proscribed three years after the registration is published.

(ii) The registration is acknowledged by the director of the National Institute for Industrial Property after examination of its formal requirements, and its publication under conditions established by Council of State decree.

Article 3. (i) Protection takes effect on the day of registration, or the date of first commercial utiliz ation, if the latter is previous to the former. It is granted to the owner of the registration until the end of the tenth calendar year that follows.

However, any registration of a topography that has not been the object of any utilization within 15 years from the date on which it was established or coded for the first time, becomes null and void.

(ii) The protection stipulated in the preceding paragraph prohibits any third party from:

Reproducing the protected topography;

Making commercial use or importing for this purpose such a reproduction or any semiconductor product that incorporates it.

This prohibition does not extend to:

Reproduction for the purpose of evaluation, analysis, or teaching;

Design based on such analysis or evaluation, of a different topography that could claim the protection of the present law.

The above prohibition does not apply to the good-faith buyer of a semiconductor product, except to the obligation of a fair indemnity if he intends to undertake the commercial utilization of the product thus acquired.

Article 4. Articles 40, 43, 44, 46, 59, 67, and 68 of Law No 68-1 of 2 January 1968 on patents, are applicable to the conditions and forms under which the decisions of the director of the National Institute for Industrial Property are taken, the rights associated with the registration are transmitted, proffered as guarantee, or vested, and the disputes created by the present law are settled.

Article 5. (i) The following are eligible to benefit under the present title:

(a) Designers who are nationals of a member state of the European Economic Community, or who either usually reside or have an effective and serious industrial or commercial establishment in one of these states, as well as their assignees;

(b) Persons meeting the preceding nationality, residence, or establishment conditions, who in a member state proceed for the first time in the world, to commercially use a topography that is not protected by the present law, and for which they have obtained from the entitled person an exclusive authorization for the entire European Economic Community.

(ii) Persons other than those described in the preceding paragraph are eligible for the benefits of the present law under condition of verified reciprocity with their country of nationality or the country in which they are established.

Summary of Computer Security Law

36980129 Paris ZERO UN INFORMATIQUE in French 23 Nov 87 p 35

[Article by Vincent Baculard: "Birth of A Computer Penal Law"]

[Text] The need to fight against computer fraud has led the industrialized nations to adopt specific legislation. In France, the Godfrain Law (the document was introduced at the initiative of the RPR representative from Aveyron, Jacques Godfrain) adopted this summer at its first reading by the National Assembly, and approved on 4 November by the Senate, belongs to a legal category that regulates the protection of authors' rights and individual freedoms.

At the present stage of French legislation, offenses specific to computers cannot be punished. The only offenses that can be penalized are the destruction or physical theft of equipment, or unauthorized access to information protected as defense secrets or professional secrets. The law proposal extends some existing accusations and creates new offenses, such as the unauthorized entry or attempted entry into an information processing system, and the unauthorized tapping of data or recorded programs.

The Senate's Commission on Laws has examined this document, focusing its attention on defining the concept of system and of system manager, and resolutely intending to create new violations rather than simply extending existing ones. At the same time, it rejects the concept of counterfeit and the use of counterfeit information due to the difficulty of comparing computer recordings to writings for the purposes of proof. Penal protection is granted only to systems provided with a security device.

The Senate has first worked on defining the object of a fraud: an automatic data processing system is an "aggregate composed of one or several processing units, memories, software, input/output devices, and connections, which operate together toward a determined result, this aggregate being protected by security devices." This is a definition which takes into account pirating performed directly on the equipment, as well as that carried out through a network or communication system. The concept of property is difficult to adapt to computer systems due to the large number of connections and to the ephemeral nature of the data and information.

The Senate has thus adapted the concept of "file manager" accepted by the Convention For The Protection Of The Individual adopted by the Council of Europe, and introduced the concept of "system manager." The person who is the subject of the fraud is therefore identifiable and can be indemnified. One of the most remarkable innovations of the law proposal is that penal protection is granted only to systems equipped with a security device. This provision, which was found only in the parliamentary documents of the National Assembly, was reintroduced into the document by the Senate Commission .

Two types of infractions specific to computer offenses have been retained: fraudulent access or residence in an automatic data processing system, and computer piracy. The concept of fraudulent access makes it possible to punish persons who have by-passed a security device—

such as decoding—to enter a system, or who have used the password of an authorized person, all of this in the absence of any prejudicial consequences.

The report of the Senate Commission enhances the text voted by the Assembly by punishing with the same penalty the person who has normal access to part of a system and who enters another part of the system without authorization. The proposed wording even stipulates penalties for remaining in one part of a system when access was obtained accidentally and when the person involved is aware that it is not authorized to do so. The stipulated penalties are greater if the system has been damaged.

"Pirating is first and foremost a takeover of power, which provides unwarranted control of an automatic data processing system." Voluntary substitution for a system manager in order to control equipment, connections, data, or software, will be punished with penalties of up to five years of prison and fines of two million francs. In both cases—fraudulent access and pirating—simple attempts and the actual offenses will be punished in the same way.

To block expert hackers, the Senate adopts the provisions of the Penal Code regarding criminal associations, by punishing agreements aimed at planning pirating. Maybe the Godfrain Law will signify the end of the "pirates' club."

11023

France Adopts Law on Data Processing Fraud

36980147d Paris AFP SCIENCES in French 23 Dec 87 pp 22-23

[Unsigned article: "France: Draft Law Against Computer Fraud Adopted"]

[Text] Paris—On 21 December, the National Assembly deputies adopted on its second reading, the draft law of deputy Jacques Godfrain, RPR, which aims to curb computer fraud. The Assembly having modified the text approved in November by the Senate, the law must now be reconveyed to the Senate at the Palais du Luxembourg.

On most of the points, the deputies wanted to revert to the initial text they adopted in June, which establishes a range of fines (from 2000 to 200,000 francs) and prison sentences (from two months to five years) against those who illegally penetrate computer systems, and those who erase or change their data.

It defines five categories of crimes. The *basic offense* concerns simple fraudulent access to a computer system: it will cost those who commit it two months to one year of prison, and 2000 to 50,000 francs in fines. When a pirate's intrusion causes the computer to malfunction, the bill is higher: two months to two years of prison, and 10,000 to 100,000 francs in fines.

The last three categories of crimes cover those who voluntarily change the information contained in a system or data bank. The penalties can reach five years of prison and 200,000 francs in fines, when the data is changed "*with the purpose of altering the truth.*" The deputies have also accepted an article added by the Senate, aimed at incriminating criminal confederations for computer fraud.

11023

COSINE Project Enhances Data Transmission Throughout Europe

3698m168 Bonn BMFT JOURNAL in German No 6, Dec 87 p 2

[Text] The establishment of the European research network COSINE, under development since the first EUREKA conference in Hannover, has had a large response. It is the EUREKA project in which all partners and the EC Commission have guaranteed or planned their participation.

COSINE is designed to provide data services to support academic and industrial research. The project proposal for COSINE is oriented toward the German research network.

COSINE should help to stimulate similar infrastructural measures in neighboring countries and for those that are already under construction, should help to establish a common technical base which would also have economic advantages.

An additional industrial policy is being established to face the problems of COSINE partners, according to which communications services can be provided following the European regulations within the international standards for open systems (OSI), and the currently available postal communications services must be used and developed by means of industrial packages. This should from the outset avoid expensive additional performance-reducing network conversions between mutually incompatible networks. COSINE's orientation toward European functional standards and its large number of computers from several different manufacturers makes it not only the greatest demonstration project so far, but also the test of the European OSI standards. One significant advantage of COSINE is that it has forged a common political will and awareness among the participating countries that if research and development in the field of data communications is to be established worldwide it must move across national borders already in the preliminary phase of standard setting.

08702

Special Programs Highlight West European AI, Neural Network R&D

Neural Network R&D Summary

3698a158 London EUROPEAN SEMINAR ON NEURAL COMPUTING PROCEEDINGS in English 8-9 Feb 88 pp 143-148

[Paper read by J.Y. Le Texier of Thomson-CSF, Division Systemes Electroniques: "Neural Networks: A European Perspective"]

[Text]

1. Introduction

A formidable boom is now taking place in the US on the neurocomputing theme: federal agencies, big and small companies are launching their research programs, universities are setting up pluridisciplinary specialized research centers and organizing special curriculae for students. At the same time, Japan talks about sixth generation computers and the ambitious "Human Frontier Science Program". How is Europe prepared to resist such competition in this emerging new technology?

A general survey of European research, far from being exhaustive, will intend to demonstrate the extremely rich scientific potential of Europe for fundamental research in the field.

The future of Europe in the domain is rather a matter of research coordination across disciplines and countries: national and community funding programmes currently encouraging such coordinated fundamental research effort are presented.

But, if Europe is willing to keep up with international competition, it is also necessary to hasten technological transfers towards the industry: an ESPRIT-II proposal for a 5-year programme gathering several major European companies is also presented.

2. European Survey

This quick survey of European research resources is organized into three parts, each one around a pole of research corresponding to a certain viewpoint to the field and a particular scientific background.

2.1 Neural Modelling

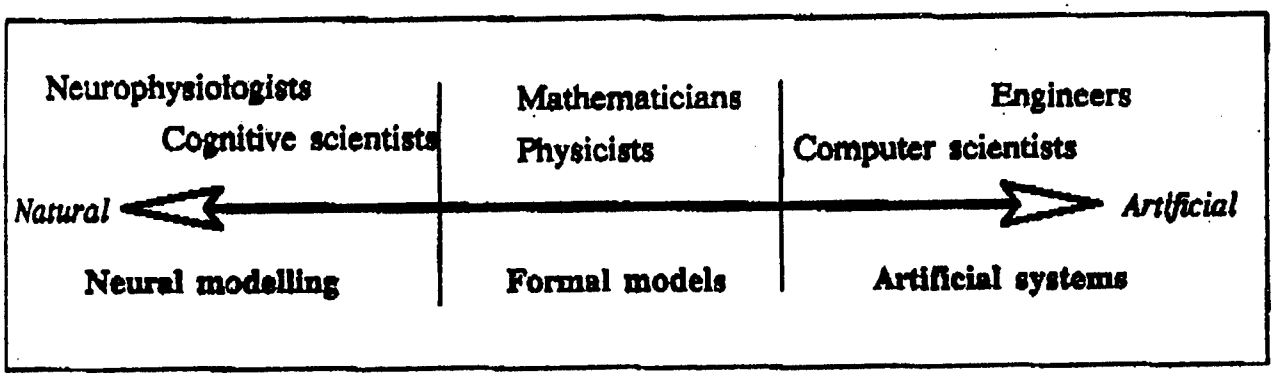
Neural modelling is the part of the research investigating the structural and functional organization of animal brains from anexperimental point of view, using anatomical, electrophysiological and behavioural evidence. As an observational science and essentially bottom-up approach, it is concerned with establishing bridges between high-level mental functions and neural activity. It often consists of generating models, explored through computer simulations, and incrementally modify them to come to a better fit with observed data.

Numerous centers are actively carrying out such research work. To name only a few:

- R. Eckmiller, at the Department of Biocybernetics at the University of Duesseldorf (FRG), whose research interests include the neural control of eye and hand movements in primates, as well as the development of Neural Networks for sensorimeter coordinate transform and motor program generation in intelligent robots;

- W. Singer, at the Max-Planck Institute for Brain Research at Frankfurt (FRG), is doing research on the mammalian visual system and collaborates with W. Phillips from the Department of Psychology and Computer Science in Stirling (UK);

- A. Berthoz, the CNRS laboratory of Sensory Neurobiology in Paris, whose activities include intracellular studies of neural circuits controlling eye movements and modelling of visual motion perception. They work in collaboration with A. Roucoux from the laboratory of Neurophysiology of the Catholic University of Louvain in Brussels;



- J. O'Keefe, at University College of London, doing research on the hyppocampus, part of the brain supposed to be responsible for orientation capabilities in mammals;

- D. Mastebroek, at the Biophysics Department of Groningen University (Netherlands), pursues an original line of research by studying the fly (Calliphora erythrocephala), and particularly its visual system.

2.2 Formal Models

This part covers contributions of researchers with a background in theoretical sciences—mathematics, theoretical physics, theoretical computer science. They use formal theoretical tools (statistical mechanics, automata theory, information theory...) to study, in a top-down approach, the information processing capabilities of networks of elementary cells or processors.

The idea of modelling neurons by threshold automata can be traced back to McCulloch and Pitts (1942). A renewed interest to the domain is due to the work of physicist Hopfield on associative memories (1982), suggesting to use networks of such automata to retrieve partially altered information. The model has been derived by analogy with research on physical disordered systems (spin-glass model).

A large number of theoretical physicists currently work on neural network models. Among them:

- Teuvo Kohonen has been working on associative memories and later set a mathematical framework on the theory of self-organization, based on neurophysiological evidence.

- C. von der Marlsburg also works on models of organization of the brain, with application to the visual system. He currently works with E. Bienenstock on a model, radically original, providing an elegant solution to invariant pattern recognition.

- P. Peretto and J.J. Niez (CEA—Nuclear Energy Commission—in Grenoble) have cast the description of associative memories in a probabilistic framework. Peretto also designed a hybrid analog-digital machine with impressive performances.

- G. Dreyfus and L. Personnaz (ESPCI Paris) work on associative memories, on a Hopfield network, with particular learning algorithms (projection rule).

- D.J. Wallace in Great Britain, E. Caianello in Italy, G. Toulouse in France, J. Hertz in Denmark, all theoretical physicists, have had considerable influence on the development of connectionist research in their own countries.

In parallel with the physicists, mathematicians and theoretical computer scientists have been studying the dynamical properties and computational abilities of automata networks. Von Neumann initiated such research by looking for a model that would be valid for both living systems and machines: work on cellular automata and discrete iteration models is an offspring of these early studies. An important pole of research is in Grenoble, at IMAG, with contributions from F. and Y. Robert, M. Tchuente, J. Demongeot and G.Y. Vichniac (now at M.I.T.). Parallel processing capabilities of systolic arrays of integrated processors, made possible by VLSI technology, renewed interest to the field, now intensively studied all over Europe: for more information, see the Proceedings of the third International Workshop on Parallel Processing By Cellular Automata and Arrays held in Berlin in 1986.

On another line of research, looking at the supervised learning capabilities of automata networks, Y. Le Cun and F. Fogelman (University of Paris V) discovered the backpropagation algorithm (similar to Rumelhart's), now widely known, studied, and experimented all over the world.

2.3 Artificial Neural Systems

This part of the research represents the effort to bring results in the preceding areas to the engineering realm. Such a task, requiring computer scientists' and engineers' contributions, bound to increase in the coming years, is double-folded:

-it must provide tools to support the research, particularly software simulation environments running on parallel architecture machines, and, on a longer term, offer solutions to the integration of the models on physical devices;

- it must validate the models, and verify their applicability by testing them on real-world applications.

Simulation of neural networks is extremely computer-intensive. One can either use supercomputers, general-purpose parallel hardware, dedicated massively parallel machines, special-purpose integrated circuits.

The group around D.J. Wallace at Edinburgh, in collaboration with D. Bounds at R.S.R.E. Malvern, makes use of various hardware supports: the Meiko computing surface and the I.C.L. Distributed Array Processor. L.S. Smith at Stirling University also implements neural nets on Transputer-based machines, F. Robert at IMAG uses an Intel hypercube, and works on the design of a Neurocomputer, in collaboration with other research centers in Grenoble, including Herault's group at INPG which already developed a prototype machine for signal processing.

In Texas Instruments, at Bradford, S. Garth also works on a low-cost dedicated parallel machine, based on a modular assembling of elementary boards. P. Treleaven at University College of London works on the design of a massively parallel architecture.

Integration experiments are being conducted: A. Murray, at Edinburgh, designed a chip for the Hopfield model. M. Weinfeld, at Ecole Polytechnique, implements the learning algorithm developed by G. Dreyfus and L. Personnaz on a chip.

Among application works, to quote the most recent European contributions, R. Durbin (Oxford) and D.J. Willshaw (Edinburgh), inspired from von der Marlsburg's work, developed the elastic net algorithm to solve the classical traveling salesman problem. J. Herault in Grenoble developed an algorithm performing signal separation on a mixed signal of independent sources.

3. Funding of European Research

Up to now, European research has been funded by national scientific research in the various domains already mentioned. Recent coordinated programs are sketched hereafter, the German government research program, the BRAIN initiative from the EEC, and a potential ESPRIT-II project for industrial R&D.

3.1 Germany

The government of Federal Germany has initiated major funding of approximately DM10 million per year over a 10-year period starting in January 1988. This concerted effort set by the Ministry of Research and Industry (BMFT) concerns 8 research groups on Information Processing in Neural Architectures.

Reinforcing the federal effort, the state of North Westphalia supports a programme of research in Neuro-Informatic by establishing 4 endowed tenured professorships, 2 at Duesseldorf University (strong background in Neurophysiology) and 2 at Bochum (strong engineering background). The aim of these programs is to study the transfer of brain functions to Computer Science, with the specific goal of developing intelligent robots, working by federation of special-purpose integrated neurocomputers.

3.2 The BRAIN Initiative

As an initiative from DG XII of the EEC, a stimulation action named BRAIN (Basic Research in Adaptive Intelligence and Neurocomputing) has been launched in 1987. The purpose is to support research collaboration aimed at a better understanding of how the brain works, and the design of machines capable of emulating some of its task-oriented problem-solving capacity.

A committee of experts has chosen 6 projects, for a level of funding close to 1 million ECU. The program is expected to show that with limited resource a great deal can be achieved by sharing expertise at a European level: in total, 28 labs and 100 researchers are concerned.

The list of accepted projects is as follows:

- Connectionist models for AI
- Learning in automata networks: towards a neurocomputer
- Neural networks for Data Processing
- Distributed matrix memories
- Spatial and temporal transformations
- Graph-matching approaches of invariant perception

3.3 An Esprit-II Proposal

The BRAIN research effort is a stimulation action, aimed at academic research centers. The field being evolving towards a more industrial dimension, another level of community funding is necessary to keep Europe on a par with Japanese and American competition.

Though only a proposal, partners from 8 different European countries involving large industrial companies (Thomson, Philips, Siemens) are now proposing to the EEC an ESPRIT-II project on Neurocomputing. This 5-year project is conceived as an industrial R&D approach to connectionism, covering the spectrum of related technical issues. It is organized in distinct layers: applications, dedicated high-level language and simulation tools, parallel architecture support, VLSI and WSI integration.

It is proposed to demonstrate the utility of these techniques by developing a range of applications mainly applying to the field of sensory-data processing (image processing, speech processing, robot control...). They will provide the means for performance evaluation and refinements at all levels of the project.

As support tools for these studies, a connectionist software environment will be developed, including a high-level object-oriented dedicated language and a simulation and testing environment. Those tools will be made available on existing European parallel computers and on workstations (Supernode, DOOM), establishing a de facto standard for European software interchange, highly beneficial to the European research community. As a major undertaking, a massively parallel machine for emulation of connectionist models, a Neurocomputer, will be designed to provide the needed European hardware platform for the domain. In parallel, VLSI and WSI integration of specific models will be explored as a basis for future application-dedicated architectures.

4. Conclusion

Integration of results stemming from neural network research is of critical importance for European Information Technology since those models appear to offer both a framework for taking advantage of hardware improvements, and a complement to symbolic Artificial Intelligence by providing real-time sensory-processing capabilities.

In order to keep its level of competence in this emerging field, it is essential to organize European research, and encourage initiatives of creation of dedicated research centers, analogous to the Computer and Neural System Center at CalTech or the Center for Adaptation Systems at Boston University. There should also be an increased communication between academic and industrial researchers in order to enhance coherence and coordination of the efforts and prepare the industrialization of results.

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- Proceedings of the IEEE Conference on Neural Information Processing, Denver, 1987

EC Adopts 6 'BRAIN' Projects

3698m156 Bonn TECHNOLOGIE NACHRICHTEN-MANAGEMENT INFORMATIONEN in German
No 469/470, 16 Dec 87 pp 17-18

[Text] The EC Commission has now passed the first six projects within the framework of the European research program BRAIN (Basic Research in Adaptive Intelligence and Neurocomputing). For the six programs, Brussels will make available a total of ECU900,000 (1 ECU = DM2.07).

The acronym BRAIN refers to the scope of the new EC program, which the [European] community intends to use for subsidizing basic research in the area of artificial intelligence and neural computers. Just as the early developers of aircraft took the flight of birds as an example, modern science is taking the human brain as its point of reference for the development of computers.

European scientists will jointly research the human brain within the framework of BRAIN. Based on the results of this research, they will attempt to build computers which, to some extent, are able to think and learn. The human brain will be the model for the construction of these "neural computers."

Experts of the EC Commission estimate that in coming years the field of artificial intelligence will develop into an important economic sector. The BRAIN program is intended to give Europeans a leading position in the worldwide technological competition.

As in most EC research programs, industrial companies, research institutions, and universities are participating in BRAIN, and partners from at least two member states must participate in any single project. A total of 28 research institutions and approximately 100 scientists will work on the six just approved projects.

One of these projects, carried out jointly by the University of Dortmund, research institutes in Grenoble, France, and the University of Sterling in Great Britain is aimed at the development of a neural computer that is able to learn. Another project, in which the Ecole Normale Superieure in Paris and the Netherlands company Philips are participating, intends to prove the superiority of neural computers in processing data containing pictures. Among the participants in the remaining projects are well known institutions such as the Max Planck Institute in Frankfurt and the University of Cambridge.

08617

Overview of February 1988 Seminar

3698a157 London EUROPEAN SEMINAR ON NEURAL COMPUTING PROCEEDINGS in English
8-9 Feb 88 pp 1, 3

[Overview of chairman, speakers, and program of the European Seminar on Neural Computing of 8-9 February 1988 at the Cumberland Hotel, London]

[Text]

Chairman and Speakers:

CHAIRMAN AND SPEAKERS

	Institute
Chairman:	
John Elmore	Head of Division, Advanced Information Processing and Software Technology, Commission of the European Communities
Speakers:	
Dr David Willshaw	Centre for Cognitive Science, University of Edinburgh
Michael Recce	Departments of Computer Science and Anatomy, University College London
Professor Philip Treleaven	Department of Computer Science, University College London
Professor Teuvo Kohonen	Department of Technical Physics, Helsinki University of Technology

CHAIRMAN AND SPEAKERS

Chairman:	Institute
Dr Robert Hecht-Nielsen	Hecht-Nielsen Neurocomputer Corporation
Jan Korst	Philips Research Laboratories
Jean Yves Le Texier	Division Systemes Electroniques, Thomson-CSF
Dr Heinz W. Muehlenbein	Gesellschaft fuer Mathematik und Datenverarbeitung mbH (GMD)
Dr Gen Matsumoto	Section Chief, Analogue Information Section, Division of Computer Systems, Electrotechnical Laboratory, MITI

Seminar Program:

Day One:

NEURAL SYSTEM AND MODELS

Speaker: David Willshaw

CONNECTIONIST MODELS: Background and Emergent Properties

Speaker: Michael Recce

PROGRAMMING LANGUAGES FOR NEUROCOMPUTERS

Speakers: Philip Treleaven and Michael Recce

ASSOCIATIVE MEMORIES AND REPRESENTATIVES OF KNOWLEDGE AS INTERNAL STATES IN DISTRIBUTED SYSTEMS

Speaker: Teuvo Kohonen

NEUROCOMPUTING APPLICATIONS - A United States Perspective

Day Two:

PARALLEL ARCHITECTURES FOR NEUROCOMPUTERS

Speaker: Philip Treleaven

COMBINATORIAL OPTIMIZATION ON A BOLTZMANN MACHINE

Speaker: Jan H. M. Korst

NEURAL NETWORKS: A European Perspective

ADAPTATION IN OPEN SYSTEMS: Learning and Evolution

Speaker: Heinz W. Muehlenbein

NEUROCOMPUTING - Neurons as Microcomputers (Part I)

Speaker: Gen Matsumoto

NEUROCOMPUTING - Neurons as Microcomputers (Part II)

Speaker: Gen Matsumoto

DISCUSSION: Trends in Neural Computing

Close of Seminar

Connectionist Models

3698a157 London EUROPEAN SEMINAR ON NEURAL COMPUTING PROCEEDINGS in English 8-9 Feb 88 p 17

[Abstract of article by Michael Recce, Department of Computer Science, University College London: "Connectionist Models: Background and Emergent Properties"]

[Text] The goal of neural computers is based on an attempt to mimic the brain's function, by emulating its structure. But it is the abstraction of these neuroscience concepts into the field of connectionism which has provided the progress into designing and programming neural computers.

Prior to the current wave of interest in connectionism, the framework was established in the 1960s by the development of perceptron models. The primary contribution during this period was a simple perceptron learning paradigm. This paradigm and its limitations will be discussed.

Current research in connectionism subdivides into two areas namely associative memories and learning systems. With associative memories, information can be retrieved based on the content of the memory (auto-associator), or a relationship between remembered pieces of information (pair-associator). With learning systems, data is presented according to a set of rules, and the task is for the system to extract the underlying patterns.

This talk provides an introduction to current connectionist research areas, which are then examined in detail in later talks.

Programming Languages

3698a157 London EUROPEAN SEMINAR ON NEURAL COMPUTING PROCEEDINGS in English 8-9 Feb 88 p 29

[Abstract of article by Philip Treleaven and Michael Recce, Department of Computer Science, University College London: "Programming Languages for Neurocomputers"]

[Text] Programming languages for neural computers still remains one of the least developed research areas. Historically, each novel class of parallel computers is associated with a corresponding class of high level programming language. Neural computer programming languages will develop partially through absorption of appropriate concepts from current parallel languages.

This paper firstly reviews the major classes of parallel programming languages and discusses potential contributions to neural networks. Language classes presented include Communicating Processes, Object-Oriented, Data Flow, Logic and Semantic Network. Then current proposals for neural network languages, such as ANNE, CONE, P3 and NIL will be discussed.

Associative Memories

3698a157 London EUROPEAN SEMINAR ON NEURAL COMPUTING PROCEEDINGS in English 8-9 Feb 88 p 53

[Abstract of article by Teuvo Kohonen, Helsinki University of Technology, Laboratory of Computer and Information Science: "Associative Memories and Representations of Knowledge as Internal States in Distributed Systems"]

[Text] Two of the main aspects of biological memory are: 1. Structure of internal representations of knowledge in the neural network; 2. The memory mechanism itself. The questions concerning the former must be settled before the latter can be approached; therefore this paper begins with the "self-organizing maps" of the input signal space which constitute the information to be stored in a generalized distributed associative memory. The discussion then turns to distributed associative memory.

Neurocomputing Applications

3698a157 London EUROPEAN SEMINAR ON NEURAL COMPUTING PROCEEDINGS in English 8-9 Feb 88 p 65

[Overview of article by Robert Hecht-Nielsen, Hecht-Nielsen Neurocomputer Corporation, San Diego: "A United States Perspective"]

[Text] Since the invention of computing 45 years ago, there has been a strong desire to achieve information processing capabilities that are at least qualitatively similar to those possessed by animals. This dream is now beginning to be realized in the new field of neurocomputing. Neurocomputing is the engineering discipline concerned with non-programmed adaptive information processing systems called neural networks that develop transformations in response to the information environment to which they are exposed. This new technology has been pioneered by scientists and engineers around the world, and has an unusually international flavor. Neurocomputing would still not have emerged from the academic backwater in which it languished for 20 years were it not for key contributions by researchers in Europe and Japan.

Neurocomputing is a fundamentally new and different information processing paradigm. It is the first alternative to the programming paradigm that has dominated computing for the last 45 years. Neurocomputing and programmed computing are fundamentally different approaches to information processing. Neurocomputing is based upon transformations, whereas programmed computing is based on algorithms and procedures. What is being discovered is that these two types of information processing, while conceptually incompatible, are highly complementary. This talk presents an overview of the current technical status of neurocomputing, the state of the neurocomputing industry, concepts for neurocomputing applications (as well as progress being made towards realising some of these applications) and a review of the significant players in neurocomputing in the United States.

Parallel Architectures

3698a157 London EUROPEAN SEMINAR ON NEURAL COMPUTING PROCEEDINGS in English 8-9 Feb 88 p 75

[Abstract of article by Philip C. Treleaven, Department of Computer Science, University College London: "Parallel Architectures for Neurocomputers"]

[Text] Recent advances in "neural" computation models will only demonstrate their true value with the introduction of parallel computer architectures designed to optimise the computation of these models. There are three basic approaches for realising neurocomputers. Firstly, special-purpose neural network hardware implementations that are dedicated to specific models and therefore have potentially a very high performance. Secondly, neural network simulators utilising conventional hardware which are slow but allow implementation of a wide range of models. Lastly, general-purpose neurocomputers will provide a framework for executing neural models in much the same way that traditional computers address the problems of "number crunching", for which they are best suited. This framework must include a means of programming (i.e. operating system and programming languages) and the hardware must be reconfigurable in some manner.

This paper surveys current work on parallel neurocomputer architectures, concentrating on Special-Purpose hardware implementations and on General-Purpose systems.

Boltzmann Machines

3698a157 London EUROPEAN SEMINAR ON NEURAL COMPUTING PROCEEDINGS in English 8-9 Feb 88 p 105

[Abstract of article by Jan H.M. Korst and Emile H.L. Aarts, Philips Research Laboratories, Eindhoven, the Netherlands: "Combinatorial Optimization on a Boltzmann Machine"]

[Text] The problem of solving combinatorial optimization problems on a Boltzmann machine is discussed. It is shown that by choosing a specific connection pattern and appropriate connection strengths many combinatorial optimization problems can be mapped directly onto the structure of a Boltzmann machine. Thus maximization of the consensus in the Boltzmann machine is equivalent to finding an optimal solution of the corresponding optimization problem. Our approach is illustrated by numerical results obtained by applying the model of Boltzmann machines to randomly generated instances of the max cut, the independent set and the graph colouring problem. From these results it is concluded that near-optimal solutions can be obtained by using in an efficient way the characteristic features of a Boltzmann machine, viz. massive parallelism and a distributed memory.

Neural Networks in Europe

3698a157 London EUROPEAN SEMINAR ON NEURAL COMPUTING PROCEEDINGS in English 8-9 Feb 88 p 143

[Introduction to article by J.Y. Le Texier, Thomson-CSF, Division Systemes Electroniques: "Neural Networks: A European Perspective"]

[Text] A formidable boom is now taking place in the US on the Neurocomputing theme: federal agencies, big and small companies are launching their research programs, universities are setting up pluridisciplinary specialized research centers and organizing special curriculae for students. At the same time, Japan talks about sixth generation computers and the ambitious "Human Frontier Science Program". How is Europe prepared to resist such competition in this emerging new technology?

A general survey of European research, far from being exhaustive, will intend to demonstrate the extremely rich scientific potential of Europe for fundamental research in the field.

The future of Europe in the domain is rather a matter of research coordination across disciplines and countries: national and community funding programmes currently encouraging such coordinated fundamental research effort are presented.

But, if Europe is willing to keep up with international competition, it is also necessary to hasten technological transfers towards the industry: an ESPRIT-II proposal for a 5-year programme gathering several major European companies is also presented.

Adaptation in Open Systems

3698a157 London EUROPEAN SEMINAR ON NEURAL COMPUTING PROCEEDINGS in English 8-9 Feb 88 p 151

[Abstract of article by H. Muehlenbein, Gesellschaft fuer Mathematik und Datenverarbeitung mbH, Sankt Augustin, FRG: "Adaptation in Open Systems: Learning and Evolution"]

[Text] Neural networks are proposed for at least two reasons—as a model to explain how part of the brain works and as a new paradigm for parallel computation. We focus on the second, the engineering approach and investigate neural networks from a performance point of view. The performance of two models is demonstrated with complex combinatorial problems—the partitioning of general graphs and the traveling salesman problem. We then outline a minimal model for adaptation in open systems. Within this model, the fast dynamics represents learning of the individual, while the slow dynamics pushes an ensemble of individuals through a fitness surface (evolution).

Neurons as Microcomputers

3698a157 London EUROPEAN SEMINAR ON NEURAL COMPUTING PROCEEDINGS in English 8-9 Feb 88 p 163

[Abstract of article by Gen Matsumoto, Electrotechnical Laboratory, Computer Systems Division, Tsukuba Science City, Japan: "Neurocomputing—Neurons as Microcomputers]

[Text] Studies on neurocomputing should be directed in two ways which in turn influence each other: In one direction concrete neural-network solutions for specific important problems should be applied to substantiate its practical significance and, at the same time, the theoretical potentialities and limitations for computation be explored on such network models. Along this direction of study, there is a staggering accumulation of results. The alternative way is to seek a more profound understanding of the algorithms used by the CNS (the central nervous system) to process informations and to know more about the molecular and cellular mechanisms underlying specific computations and memory process in neurons and neural networks. From this point of view, artificial neurons developed for neurocomputing are oversimplified to simulate real neurons. Here I will show that neurons are analogous to microcomputers whose characteristics can be classified into over 50 kinds, and that electrical events observed in neurons are a part of

the many manifestations associated with neural activities and are regulated by the chemical and conformational processes inside neurons.

Hahn Meitner Institute, GMD Form Research Team for SUPRENUM, OSI

3698m157 Bonn TECHNOLOGIE NACHRICHTEN-MANAGEMENT INFORMATIONEN in German No 469/470, 16 Dec 87 p 13

[Text] Starting 1 January 1988, the research group, "Distributed Systems," of the Hahn-Meitner institute GmbH (HMI) in Berlin will be incorporated into the Society for Mathematics and Data Processing (GMD) as the "Research Group for Open Communications Systems" (FOKUS). FOKUS will become a research center of the GMD and will obtain the same status of the GMD's "Research Center for Innovative Computer Systems and Technology" (FIRST) in Berlin.

In March 1987, GMD and HMI, both large-scale government research institutions, signed an agreement on incorporating FOKUS and FIRST within Berlin's GMD, which is responsible for information technology.

In FIRST, approximately 60 scientists and about the same number of students are working on designing a completely new generation of computers and developing them to the marketing stage. Today's so-called Von-Neumann computers, which execute one command after the other in strict sequential order, have reached the limits of their capabilities. Future computers must be able to separate the complicated tasks of science and research—and also industry—into partial problems, have these processed in parallel and simultaneously by several hundred "subcomputers," and formulate a final solution from the results. This does not only mean that computers will have a completely different architecture and new internal organization, but that they will also have fundamentally new computing processes and programs. With its STARLET computer, the FIRST team has already developed a prototype of such a fifth generation computer which has been widely recognized internationally. At present, the team is participating in the project SUPRENUM, the "supercomputer for numerical applications." The prototype developed by this project has 256 single computers and can work simultaneously on partial aspects of the same problem.

Approximately 50 members of the FOKUS project are working on the problem of getting computers with different processing modes and from different manufacturers to communicate with one another. This is not easy with "normal" personal computers, which most people today know from their own experience. For mainframe computers the communications requirements are substantially higher: larger amounts of data must be transmitted rapidly and error free. However, this is only one basic requirement. There are the additional problems resulting from the requirement for "open" computer systems, which are freely accessible to everyone prior to clear-cut authorizations.

The FOKUS team will be responsible for the leading GMD project, "Open Applications and Intercommunications Systems" (OAI), which is mainly concerned with the development of high performance networks for computers of the future—also developed by FIRST—to permit adequate communications for these networks' high speed and performance. A prerequisite for this is broadband transmission which allows high speed transmission of graphics, technical drawings, and animated pictures. Preliminary work for the GMD's project on open applications and intercommunications systems is already underway in Berlin with the BERKOM network, in which all scientific installations of the town can be linked to each other. With 560 million bits per second, BERKOM's transmission speed will be at the frontier of the present state of the art.

08617

R&D, Competitiveness Strategies at Bull of France

International Cooperation Stressed

3698a111 Paris L'USINE NOUVELLE in French 3 Dec 87 p 8

[Article by Thierry Lucas: "Research: Cooperation in All Directions"]

[Text] Bull's research policy, coordinated by the Clayes-sous-Bois based CRG (Group Research Center), is based on partnerships and international cooperation. First illustration of this intention: Out of 250 researchers only 50 actually work in the central laboratory.

"The CRG's role is to prepare for those products that will come into being in 5 years," explains Francois Salle, the group's scientific director. "Last year these studies, upstream of actual development, represented a Fr 180-million investment, i.e., 10 percent of the entire research budget. Our policy of openness aims at tapping basic research worldwide in order to facilitate transfer to our own developments."

Modeled after the European industrial consortiums created around Unix (X-Open group) and international network standards (SPAG, involving 12 manufacturers), Bull, together with ICL and Siemens, has set up the European Computer Industry Research Center in Munich, bringing together some 50 artificial intelligence specialists.

Another priority area is software engineering, which aims to optimize programming. This time Bull's participation in an ESPRIT project has already produced a commercial product: The Emeraude GIE [Economic

Interest Group], incorporating the Eurosoft and Syseca service and software engineering companies, offers a standardized structure for building software engineering workshops.

As far as hardware is concerned, if tomorrow's computers show little resemblance with those we know today, this will largely be due to their architecture. Here too, cooperation is going full speed. Bull is the project leader for the future ISIS supercomputer for processing large data charts, while Siemens provides the integrated circuits. Several projects, especially in the ESPRIT framework, also involve parallel architectures aimed at digital computing, artificial intelligence, and database processing applications. Furthermore, research teams are working on dedicated circuit design and are cooperating with manufacturers.

In this international context, there is still no question of Bull neglecting its ties with French universities. CRG director Gerard Roucairol previously managed the data processing laboratory at the University of Orsay. Even more significant is a study project on man-machine interfaces established at INRIA [National Institute for Research on Data Processing and Automation] in Sophia-Antipolis.

"The central Honeywell laboratory is still located in the U.S. plant," Francois Salle stresses. "In return this agreement gives us a chance to establish ties with research in the United States."

1986 R&D Investments (in billion francs)

	Turnover	R&D	R&D/Turnover Ratio
Bull	17.8	1.75	10.0 percent
IBM	322	32.8	10.2 percent
Digital equipment	59.2*	6.4*	10.7 percent

(* Fiscal year 1 Jul 86 to 30 Jun 87)

25048

Bull of France Takes Steps to Compete With IBM, DEC

36980148 Paris L'USINE NOUVELLE in French 3 Dec 87 pp 4-8

[Article by Jean-Pierre Jolivet, Sylvie Bommel, Patrick Franklin, and Thierry Lucas: "Can Bull Manage Without the Government?"]

[Excerpts] For Jacques Stern and Francis Lorenz, 1988 will be the dangerous year: the government is pulling out, the computer market is stagnating, and international competition is getting harsher. A readjustment is almost inevitable, and so is a reduction in personnel.

A growth of only a few percent in 1987 revenues, barely sustained profits, personnel reductions to be expected in France after affecting 1600 workers at Honeywell Bull in the United States; after two years of recovery (profit of Fr271 million on revenues of 17.8 billion last year), the warning lights are going back on at Bull.

Presently in full recovery—reduction in administrative and production personnel, increased commercial strength—the French computer champion is reaching a difficult stage, especially since next year will mark the end of capital support from the shareholder-government.

In six years, from 1983 to 1988, the state will have allocated Fr5.6 million to Bull. Thus, at a time when the world's computer market has never been as strained, can Bull dispense with the state's support? Particularly since at this year-end, asking for the same support from the financial markets appears out of the question. This is a new game, which could force Jacques Stern, the company's CEO, who is busy with Bull's activities in the United States, and Francis Lorenz, the director general, to shift their strategy toward greater stringency, perhaps a little sooner than expected.

Having become the eighth worldwide computer builder after buying Honeywell's computer business last March, the Bull group, which is aiming at Fr30 billion this year, must adapt itself to the new look of the computer market.

Free-Falling Subsidies to Bull (in million francs)

1983	1550
1984	1200
1985	965
1986	1125
1987	500
1988 (estimated)	300

In 6 years, the state has given Bull Fr5.6 billion. However, 1988 will see the end of the subsidies, at a time time when the computer market is tighter than it has ever been, and when the demand on the financial markets is also chaotic.

This is a delicate task for a group in financial convalescence; the time for euphoria is no longer here; the 25 percent growth wave on which all the manufacturers were happily surfing, is ended. Since the 1985 "computer slump," the American market has advanced by only 10 percent per year, and for the second consecutive year, growth will not exceed eight percent in Europe.

Unlike the rest of the European computer companies, Bull must face the offensive of the two American giants on its own market. Nor did the wind of industrial liberalism that is blowing in France help improve matters. The private enclaves of the administration are no longer a buffer. Just like a goodly number of national

manufacturers, Bull, which holds 20 percent of the French market and gets 50 percent of its French sales from the public and parapublic sectors, was not spared.

"To upgrade IBM equipment, you order IBM. But for Bull equipment, you ask for bids," is Bull's bitter commentary. These are exceptions, the Ministry of Industry would like to hope, reiterating that competition remains the major goad for competitiveness, and paraphrasing Andre Giraud, who as minister of industry used to say: "Help yourself, the State will help you... a little!"

This notwithstanding, while DEC's sales increased by 26 percent and IBM's by 10 percent during the first half, Bull's revenues stagnated at Fr7.82 billion strongly affected by weak sales to the administration and to its large accounts. "Disappointing results," concludes Francis Lorenz.

This observation has thrust Jean Antier, former director of the Angers plant, which he modernized, to the directorship of the French marketing network, with the task of energizing the sales force, whose size (8500 people) has increased by 10 percent due to internal transfers. Like IBM (which retrained 1200 production and administrative employees into sales positions) or DEC (which is hiring 400 salesmen a year), Bull now wants to be closer to the customer and his needs. Christened "Presence Plus," this operation will continue next year.

Claude Porcherot, chairman of the Computer Club of Large French Enterprises (CIGREF), is full of praise: "With Bull, companies finally have customer-supplier relations worthy of the name. The remarkably improved sales teams are now comparable to those of other computer manufacturers." Timid and non-motivated salesmen, poorly managed technicians, are the past. "Today we are not ashamed to introduce ourselves wearing the Bull hat," states a sales engineer who has lived through the preceding period.

For a number of specialized observers, the market retrenchment only reveals structural problems, which must henceforth be confronted by the manufacturers in "The Bunch" (Unisys, Control Data, NCR), to which Bull belongs since buying Honeywell's computer products, products which are too diversified (and heterogeneous) to be profitable, and are linked to excessively narrow market slots.

There are those who do not hesitate to speak of a strategic dead end. Whereas the marketing costs of IBM's and DEC's products and services are respectively 40 and 48 percent, those of Bull and Unisys reach 58 and 67 percent! The bill gets stiffer with industrial costs and with research and development efforts on products that are too diversified both in hardware and software.

If Bull want to stay in the race, and especially remain in all the computer market slots, the French company will have to invest even more. Compared to the IBM and DEC giants who respectively devote 10 and 11 percent of their revenues to research and development, Bull manages to invest 7.7 percent (except for outside study contracts). To carry on such a program, you need a strong back and shareholders determined to continue their support.

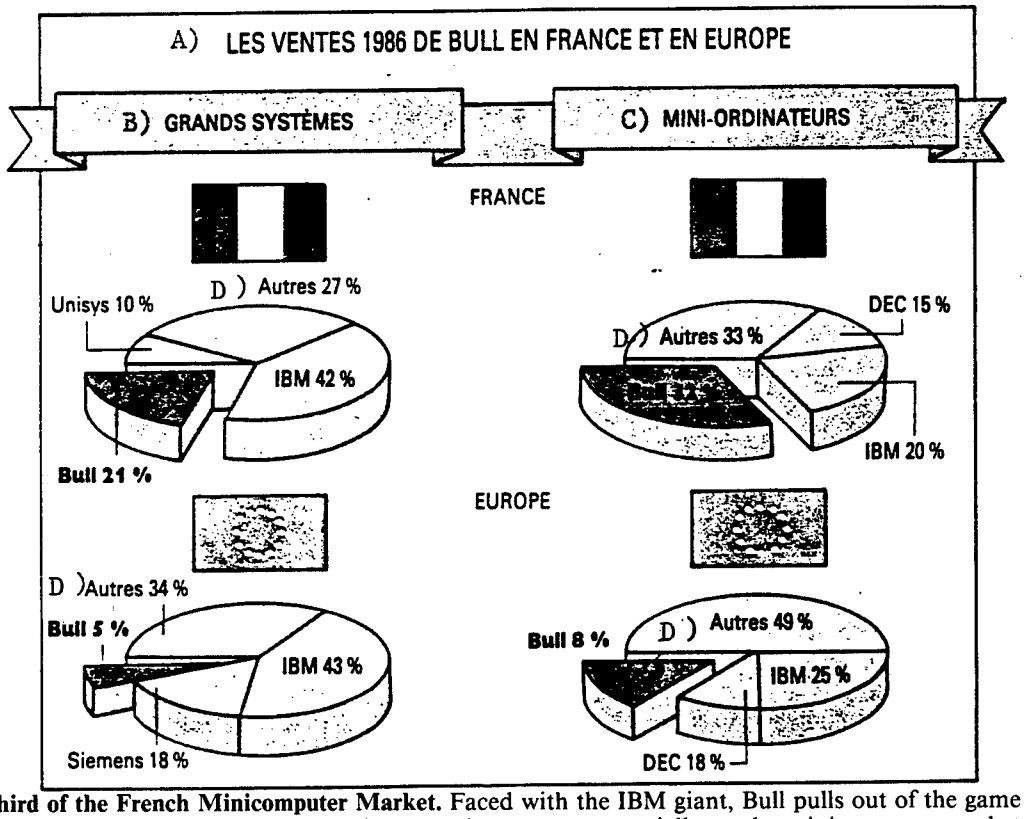
Just like The Bunch, Bull cannot avoid significant structural costs. There is of course the legacy: the products of Transac and Sems (that came into Bull's lap in 1983), the DPS families from Honeywell, the Questar terminals from Convergent Technologies, the DPS 7 designed by Bull, and NEC's DPS 90 computers. It is also the result of a sales strategy intended to cover every corner of the computer field: the SPS 9 large scientific computers acquired from the Californian Ridge Computer, the SM 90 minis developed from a CNET license, and the Micral microcomputers.

Added to the management costs (technology, industry, sales, maintenance) of such a broad range of products, is the coexistence difficulty of six operating systems: three G-COS on the DPS, MS-DOS on the micros, T-COS on the Questar terminals, and UNIX on the scientific machines.

Aware of the danger, Bull's executives reacted without delay. Under the guidance of Jacques Stern, founder of Sesa, which has become one of the major French computer service and engineering companies, Bull announced its Blue Green program one year ago: an architecture to unify computers, terminals, and application software, allowing the French company to enter the service market, where the boundaries are more comfortable. And perhaps at the time, tempted to become—like the British ICL, a service supercompany offering computer solutions. Bull already derives 50 percent of its revenues from this. "The intent to rationalize is certainly there, but we are not yet seeing any concrete results," says Claude Porcherot.

However, Bull's offer of "large and intermediate systems" has been ongoing for one year, ending up in three lines of machines around three operating systems (G-COS 6, 7, and 8), without possible transition from one to the other. Today, the users expect a decisive progress: the combination of these three lines of computers into a single family. "But at Bull we do not yet see this policy, which at IBM determined the establishment of a single architecture in response to DEC's fully compatible offer," regretfully states Claude Porcherot. Things are not as easy for Bull, which must consider its installed base, and especially guarantee the continuation of its three computer families to its customers.

A similar disappointment prevails at CUBE (Bull Users' Club), which has been urging the manufacturer for many years with very few results. Except that in recent months, CUBE's recommendations appear to reach an attentive ear, ready for discussion, rather than the polite indifference and powerlessness of the preceding years. The



One Third of the French Minicomputer Market. Faced with the IBM giant, Bull pulls out of the game on the French market. In Europe, Bull will assure its presence especially on the minicomputer market.
Key:—A) Bull's 1986 Sales in France and Europe—B) Large Systems—C) Minicomputers—D) Others

explanation comes from Claude Stouvenel, in the manufacturer's "strategy and marketing" department: "Our objective is not to merge the lines, but to provide easy communication among computers of the same type and even of different brands; a convergence rather than a single and unique system, so as to meet the needs of distributed computerization throughout an enterprise." An evolutionary plan, in other words; but it will necessarily take a long time.

The takeover of Honeywell's computer activities should speed up matters. Bull must now cover all the European markets, as well as the American ones. Today, its executives' efforts are aimed at rebalancing the DPS line of intermediate and large systems, because they represent 60 percent of the group's activity. The pacesetter is the DPS 7, a machine designed in France and built at Angers. This is a true reversal of CII-HB's history, which was blamed for being merely a distributor of foreign technologies. The DPS 7, 3500 of which have been installed in 40 countries, is a success; its sales (Fr4 billion) are growing by 25 percent per year, so much so that Bull sees its future top and bottom of the line versions as replacements for the Honeywell DPS 6 and DPS 8. This is a strong point, around which some predict Bull will have to refocus is activities, and similar to the DSA architecture, the company's other trump card.

A work horse in Europe, the DPS 7 is also the weapon for reconquering the American market, where Honeywell's position was frittering away with time. A huge challenge for Jacques Stern, chairman of Honeywell Bull Inc, and Jerry Meyer, executive director. Encouraged by the Datapro survey (satisfaction index of American users) which put the DPS 7 in first place, they have just completed a tour of the large American users of DPS 6 and 8 machines, to reassure them of the company's product policy. A strategy carried out together with a drastic restructuring in the American operations of Honeywell's former computer division: 1600 jobs eliminated among 11,500 employees (particularly at the Phoenix plant), a more dynamic sales force, and reduced operating costs. These measures should allow Honeywell Bull Inc to regain profitability beginning in 1987.

While Bull's strategy is shaping up around the "hard core" of large systems, its visibility is lower in other activities. The company did not achieve the breakthrough it expected in technical computers, and it is being hurt by Matra Datasystemes' offensive in this area. Despite a good penetration into the microcomputer market (43,000 units last year), microcomputerization (for office automation) is not yet profitable. The Villeneuve-d'Asq plant, in which it invested Fr220 million, is

far from running at full capacity, without mentioning memory cards, where despite an investment of Fr600 million, the expected results are not yet in.

All of these factors threaten the financial recovery of the group, which has wagered on strong growth. From the moment of their arrival, Stern and Lorenz addressed the two traditional ills of the former CII-HB: financial costs and productivity. In four years, the debt ratio went from 8 to 1.6, and profitability reached 1.5 percent; financial costs, although still high, were reduced from 6.4 percent in 1983, to 3.6 percent in 1986, and productivity became 1.8 times greater.

In this field, Bull is harvesting the fruits of its social policy. Since 1982, headquarters is expending enormous efforts to assure the mobilization of human resources that Francis Lorenz qualifies as an "essential component in the company's recovery." Some of this policy's principles are quality training for all personnel, exclusive recruitment of well qualified staff, and development of company spirit. The results have been objective: in the last few years, productivity has increased at an average rate of 18 percent per year; and the effect has been positive—although less quantifiable—regarding the confidence of Bull employees in its products and future, a faith that is not being scattered by the first gust of wind, such as the 1987 results. "The staff is of course relatively disappointed to discover that the end of the tunnel is not yet here. But we are not worried about the future, because we continue to observe the reliability of our equipment and receive daily confirmations of customer satisfaction. That was far from true in 1982," comments Michel Fournigault, CGC representative.

At the same time, Bull's employees are now more likely to blame the poor situation for computers in general, rather than poor performance on the part of their company. Nevertheless efforts continue. And the strike which jolted the Angers plant several weeks ago over a salary dispute, does not appear to have changed the belief that there is still progress to be made in quality and productivity.

The gentle manner with which Bull has so far succeeded in reducing its personnel undoubtedly plays a role in the overall good climate. But will it continue? That is the major uncertainty for the employees, who are finding out that early retirement or voluntary severance measures are being exhausted. Faced with these concerns, Bull's management maintains that it can avoid layoffs, but on one condition: that employees be more mobile than ever, both geographically and functionally.

If there is one trump card that Bull does not discuss, it is the aggressiveness of its force. So much ground covered in five years! A solid team is essential to confront the storm on the computer market, especially within two years from having acquired 65 percent control of Honeywell Bull Inc, and from the difficult negotiations that should be opening with the Japanese company NEC.

Research: Cooperation on All Fronts

Coordinated by the Group Research Center (CRG) located at Clayes-sous-Bois, Bull's research policy is founded on international partnership and cooperation. The first illustration of this orientation is that only 50 out of the company's 250 researchers actually work at the central laboratory.

"CRG's role," explains Francois Salle, scientific director of the group, "is to prepare the products which will see the light of day in five years. These studies, carried out ahead of the actual development, represented an investment of Fr180 million last year, amounting to 10 percent of the total research investment budget. Our starting policy is to channel the fundamental research going on throughout the world in order to facilitate its transfer to our own developments."

Like the European industrial consortiums created around UNIX (the X-Open group) and the international network standards (SPAG, which gathers together 12 manufacturers), Bull has established with ICL and Siemens, the European Computer Industry Research Center in Munich, which combines about 50 artificial intelligence specialists.

Another priority area is software engineering, aimed at optimizing programming work. In this case, Bull's participation in an Esprit project has already yielded a commercial product: GIE Emeraude, formed with the computer service and engineering companies Eurosoft and Syseca, which proposes a normalized basis for the establishment of software engineering production shops.

In terms of equipment, if tomorrow's computers will have little relation with the ones we know, it will be in a large part due to their architecture. Here again, cooperation is in full swing. Bull is prime contractor for the future Isis supercomputer, which will process large data arrays and for which Siemens is providing the integrated circuits. Several projects, notably within Esprit, also concern parallel architectures, aimed at numeric calculations, artificial intelligence, and database processing applications. In addition, researchers are working on the design of specialized circuits and are cooperating with manufacturers.

In this international context however, Bull is not neglecting its bonds with French universities. Gerard Roucairol, CRG director, formerly directed the computer laboratory at the University of Orsay. Even more significantly, a study project on the man-machine interface is installed at the Sophia-Antipolis INRIA.

"As part of the new Honeywell- [missing text in original] sustain the research effort, because Honeywell's central laboratory has remained a part of the American company," points out Francois Salle. "In return, this agreement is a chance for us to establish connections with the research going on in the United States."

Research and Development Investments in 1986 (in billion francs)

	Revenues	R&D	R&D cost ratio to revenues
Bull	17.8	ca. 1.75	ca. 10 percent

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Growth Prospects for Italian Software Sector Analyzed

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No 10, Nov 87 pp 18-27

[Article by Giuseppe Caravita: "Software: Keyword of the Computer Market"]

[Excerpts] There is a barrier, a kind of rubber wall, that has never been breached in Italy, namely a strategy for an effective industrial policy in advanced technology capable of effectively encouraging the development of new sectors and of creating present and future employment opportunities.

This is an old refrain that the reader of this article may consider boring. But something important has changed even in Italy in the last 2 or 3 years. There are signs [of change] that are destined to bring this theme to the fore in new ways.

Let us look at a few of these signs of change.

The first sign is that in telecommunications, pressure from users (especially professional users) has generated renewed agreement between the Ministry of Post [and Telecommunications] and STET on an investment program that is unprecedented in Italian history. Plans have been made to invest 40 trillion [lire] over a 5-year period (if the 1988 finance law is passed without too many cuts) in order to modernize the basic telephone network and to develop telematics at both the professional and domestic levels (there is even talk of an Italian Minitel project under study at SEAT [Company of Official Telephone Subscriber Lists] and SIP [Italian State-Owned Telephone Company]).

The second sign is that in major public and private industrial sectors there is an unprecedented stir (unprecedented at least since the 1960's) revolving around major technological projects. This can be seen from the investments made in automated factories such as the Fiat Robogate or Olivetti's Scarmagno plant.

The third sign is that projects such as Odette (integrated network for the automobile sector), EFDIC (chemical sector), and other similar EDI sectoral or intersectoral initiatives mean that small and medium-size companies will also become involved in advanced data processing and professional telematics (the electronic exchange of documents), primarily as spin-offs from major groups.

The fourth sign is that the principal computer firms are rapidly moving in this direction. Digital was first with its VAX line of integrated and compatible [software] (single VMS operating system, from the workstation to upgraded super-VAX's as powerful as mainframes, the Ethernet-Decnet network capable of being hooked up to the IBM computer, and All-In-One integrated software).

The Situation in France

At this point, I would like to suggest a brief trip to Paris. The French software industry, with 1986 sales of $3.4 billion (according to IDC estimates), is the largest in Europe, ahead of the FRG ($2.8 billion), the UK ($2.6 billion), and Italy ($1.6 billion). Why does Paris occupy such a dominant position in the software field when the French economy overall is certainly less important than that of the FRG and is by no means double the size of the Italian economy?

The answer is simple. Software has probably been the major success story in France's industrial policy. It has had a much greater success than the disappointing computer hardware field, and in fact is comparable with the aerospace sector.

Alessandro Alberigi Quaranta and Massimo Paoli in a report on this sector write that: "This leading position probably stems from the continuing, large-scale commitment that French Government authorities have demonstrated in recent years to maintain and increase the use of computer technologies."

The "strike force," Transpac (development of the French packet switching network took off in 1975), and Minitel; these and other public-sector projects created Cap Gemini Sogeti, GSI, Sema Metra, Sg2, Sesa, and Telesystems. These firms are the leaders of the European software industry (only Italy's Finsiel is in the same league in terms of size) and, together with the British [firms] Logica and Scicon, are the only ones to export software (primarily software for systems and networks) to many countries, including the United States.

The French case offers such a striking example that even the Olivetti strategists carefully studied the Sg2 case when the firm decided to enter the software sector in a big way 2 years ago. [Olivetti carried out] its policy of acquiring small innovative units and of subsequently combining them in synergic networks. This is how G4S-Syntax, the holding company comprising the 20 Olivetti associates and partners involved in software, [was started].

Alberigi Quaranta and Paoli maintain that: "The ownership pattern of the principal French firms, most of which form part of large financial holding companies or banking groups, means that they have access to far greater resources than similar-size firms in other European countries. French firms have achieved a significant world market share (including in the United States) both

through the acquisition of existing firms or the establishment of new companies in various countries, particularly in the aforementioned sectors (systems software), as well as through the sale of products developed in France or by overseas affiliates, and through the sale of consultancy [services]."

In short, the French situation can be summed up in four points: the availability of financing; the concentration of qualified human resources; projects involving high-quality public-sector demand for advanced systems software; and the development of international competitiveness.

These four ingredients, as can be seen from the "four signs" mentioned earlier, are—at least potentially—present in Italy. Here we have the opportunity for a new industrial policy.

The Situation in Italy

Let us look at the Italian situation. This was recently reviewed by Giancarlo Capitani of Nomos in an article in the 25 September issue of RESEAU devoted to software and in a survey of 100 Italian software firms conducted by the Milan-based Nomos. [This survey] was presented during the most recent Anasin meeting held at Porto Cervo on 2-3 October, and is an accurate and up-tp-date picture whose significance still has to be fully studied.

1. Size

In fourth place in Europe with 1986 sales of 4.1 trillion [lire] (representing a 26-percent increase over the previous year), 960 billion [lire] of the Italian software market is represented by hardware suppliers. The remaining 3.14 trillion [lire] is produced by approximately 3,000 firms with 44,000 employees, and with an everage size of only 15 employees per firm. By comparison, the average French firm has 28 employees (with a total of 2,000 firms), and the average British company has 23.

However, the Italian sector is going through a phase of "catching up" on average European levels (and the signs mentioned earlier would appear to confirm this), and currently covers approximately 40 percent of the overall Italian computer market (11 trillion [lire] in 1986), against only 30 percent 4 years ago. In the 5 years between 1986 and 1991, the Italian software market will triple in size, going from $2.8 billion to $8.7 billion, while France will go from 6.6 to 16.6, the FRG from 4.7 to 12.7, the UK from 4.5 to 10.7, and the United States from 54.9 to 123.

If the Italian hardware sector continues at the "slow pace" it registered in 1986 (growth of only 7 percent), it is estimated that the software component will represent more than 50 percent of the overall market by 1990.

Therefore, the stakes are high in the software industry and continue to grow, for computer manufacturers as well.

Italy currently constitutes a "target market" with high profit expectations for the major American software firms (which can count on a non-fragmented internal market double the size of the European market). Firms such as SAS Institute, MSA, Pansophic, Uccel, Computer Associates, and Information Builders have opened Italian offices in the last 2 years, while Cap Gemini has acquired Geda, and Arthur Andersen has begun to distribute its own software products.

Without fear of exaggeration, the Italian software sector is the most fragile in Europe, despite the fact that we are in the midst of a phase of strong and continuous "thrust" and a growing interest on the part of major Italian and foreign industries.

2. The Health of the Sector

The Nomos review of the situation brings to light both bright and dark spots. On the bright side of the picture there is the vitality of firms that will grow by an average of 25 percent in 1987, with higher growth rates in the small software houses with sales of between 500 million and 2 billion [lire], which are just arriving at the first critical threshhold in terms of size (with [sales of] 2 billion [lire] or more, a software house exchanges the status of a "professional studio" for the status of a "firm.")

Thus Italian software companies appear to be going through a very delicate period in their development: they want to continue to grow rapidly, but they are also beginning to consider problems such as company management, organizational structures (for example, marketing), financial resources, and increasing profitability.

Moreover, the Italian software sector, unlike the French sector, did not originate in the halls of the presidential palace or on the boards of directors of major financial groups. It originated in a wholly Italian setting, starting from the grass-roots level with more than 2,000 firms (90 percent of which were founded by data processing experts starting their own firms) that had no more than 10 clients when they were founded.

The activity of these companies was strictly local in scope or directed at a specific technological market niche. It is only today, in a nucleus of no more than 200 firms, that the question of management organization is being raised, while the rest of the sector is pervaded by this "thrust" from the grass-roots level (a recent survey conducted last year in the province of Turin estimates that 5,000 companies were started in 1986, more than 300 of which were "micro-units" producing software).

Starting up on such a small scale leads, for a long time, to "demand dependence" (particularly [dependence] on the sophisticated demand from large firms), as well as an inability to provide the financing necessary to develop either investments in new products or, at a more ordinary level, any kind of sophisticated strategy capable of defining the firm's role in a competitive field rapidly becoming more and more crowded. This gives rise to the impression that the Italian software market is like the "Wild West," especially in the less sophisticated areas and products (such as data processing, software distribution, business management, and personal computer standards).

3. Obstacles

Financing is by far the biggest obstacle to the development of firms: 23 percent of companies are wholly dependent on the proceeds from their own activity; 60 percent do not even have access to ordinary bank credit; and only 4 percent have managed to obtain money from the government. Given this context, it is unrealistic to think about the development of Italian software products for export, particularly complex systems software.

The path to software innovation in Italy, in fact, appears to be a particularly tortuous one: 55 percent of firms can innovate only within the framework of advanced projects accepted (or sponsored) by an individual (large) customer; 20 percent of firms simply import from the United States or other more advanced markets; and 30 percent of firms carry out market studies or develop products from their research. But (custom) "demand" is still by far the most important incentive for innovation in the sector. This is a phase typical of a young and still fragile industry, in which the large customer often simply dictates its conditions to satellites that have no say in the matter.

The paths taken by innovation lead one to conclude that there are four main types of firm [in this sector]: medium-size software houses operating in their own geographical areas for small and medium-size customers, which tend to develop management applications for vertical markets (40.5 percent); firms working with bigger customers in the telecommunications and data communications sector; small firms, highly specialized in individual sectors (ranging from expert systems to industrial automation); and lastly, software houses which originated in major customers and which, for the time being, are working on horizontal management systems while trying to define their own role.

Some interesting conclusions can be drawn from this information. Capitani hints at this when he says that the driving force behind the development of Italian software firms is coming to be the "captive demand" from large industry, which tends to gather around its own projects sophisticated medium-size software houses and even small highly specialized market-niche firms.

4. Structural Organization

Is this a "healthy" model to follow? The author of this article has strong doubts because the Italian software sector is still, to a great extent, at "craft" [artigianale] level, and risks becoming even more "demand dependent" over the next few years, while the real quantum leap required of the sector would appear to be in the areas of organization, financing, partnerships, independent product development, and, in the final analysis, greater international involvement.

The captive demand trend from major industries, when supplemented by effective measures in these other areas, can be highly synergic. Without these measures, it looks as though a situation favoring "up-scale" software will continue.

Let us now take a look at the key factors limiting the sector. These are primarily organizational, since 67 percent of the firms has a structure based on one level only and organized according to products-services, almost always without any staff functions. The majority of the firms (58 percent) do no research and development, not even in terms of time dedicated to this by their own technical personnel (however, 30 percent would like to do so in the future). This is why international competitive capabilities are almost nonexistent. Only 2.9 percent of sales in the sector come from exports and sales from subsidiaries, compared to 20.3 percent in France, 14 percent in the UK, and 11 percent in the FRG.

The medium-size Italian software entrepreneur would first like to see growth in the products and services he is currently working on (64 percent mention this goal); he would like to rid himself for good of the restricted and provincial [locale] mentality in which he finds himself (this is still true for 48 percent of the firms). This need to grow through market expansion is accompanied by a need to increase the managerial efficiency of the firm, to consolidate its organizational structures, and to increase profitability.

In the case of the major firms, the survey reveals that "growth means differentiation and gaining a substantial share of the world market, in order to move outside a highly competitive and overcrowded area." This is an explicit identikit even of the dozen or so Italian software houses of a reasonable size (that is, with sales over 20 billion [lire]) but which can still not be considered leaders in specific sectors, but only large firms that were born and often grew in captive market "macroniches" (for example Finsiel for the public administration, Enidata within the ENI [National Organization of Hydrocarbons] Group, and Data Management in bank data processing). When one considers that 30 percent of the firms surveyed by Nomos in the 5-20 billion [lire] sector [of the market] have at most 50 customers, can one really say that there is a genuine supply of software in Italy? Or is this a sector about to undergo a process of industrialization, concentration, and selection?

5. Key Points for Developing a Strategy

We said before that the lack of financing was the factor most often mentioned by the firms. However, this is not the only factor; human resources, at one time rather abundant, currently represent a strategic problem in terms of both cost and training. Among the problems most often mentioned, financing comes up 24 percent of the time and human resources 22 percent of the time.

Overall, what we see in the Nomos-Anasin survey is a kind of dual model. Here we have a sector with a great deal of technological entrepreneurship that Italian data processing personnel developed spontaneously over the past 2 decades and that is only now beginning to split into two groups: on the one hand, there are the groupings that have developed around the major projects of large industries (here we find some of the principal software houses surrounded by clusters of small specialized firms), while on the other hand, a local and niche-oriented supply continues to exist.

The process is underway. According to research, as many as 84 percent of the firms have established agreements and partnerships in the last 5 years. The best known case is Olivetti's strategy of acquiring or buying shares in various innovative firms centered around the G4S (formerly Syntax) system. However, an active policy that promotes partnerships and agreements is already becoming essential for future development, and there is already a strong demand for this from entrepreneurs.

The creation of centers consisting of networks of companies thus appears to be the only realistic way to resolve the problem of financing. The financial holding companies that will make up this future segment of the Italian software sector will be able to act as links among banks, government funding sources, credit markets, and company projects. This is not the only function they can serve because, given that they will have marketing and market survey capabilities, they will be able to develop and plan new products and services. In short, on the basis of the mutually accepted "network model," there appear to be all the conditions necessary to establish a French-style supply side within 10 years at the most.

There is a second key factor, which is that up until now government demand for software and systems has been qualitatively and quantitatively unimportant for the sector's development. The government budget office estimated that last year the national government sector ordered only 32 billion [lire] worth of software in areas involving basic computer technology. Obviously there are exceptions, [such as] the Finsiel Group, which developed from major public data processing projects, and which is now in a position to put itself forward [and already does, in fact] as one of the future poles of aggregation.

But it is possible that this lack of government demand may change over the next few years. Let us just consider the major investments coming up in telecommunications and the possibility that the most advanced Italian software houses will get involved in these projects (for example in "optical islands") with added-value systems and new services that can be exported (another reason to develop a policy similar to that of France).

Thus the way in which this 40 trillion [lire] is divided up and spent is crucial. Here a specialization principle well known to programmers throughout the world is applicable, that is, that if telecommunications firms intend to keep control of all the projects, even those in the area of the most sensitive software components, in their own hands, it is probable that this will lead to inefficiency and additional costs (or we may simply import products developed by others). We have seen some good examples of this in the past. However, if the Ministry of Post and Telecommunications (as the disbursing agency) and SIP [Italian Telephone Company] are capable of understanding the specific nature of software, it is probable that another pole—potentially competive at world level—will develop around these two bodies and the new telecommunications networks.

Training is a third factor. In data processing courses and in polytechnics a growing number of undergraduate research theses [tesi di laurea] are increasingly coming to resemble authentic feasibility studies for software innovations. There is a chance that this wealth of youthful ideas (the real wealth of American universities) will not be lost. All that is needed are incentives to create innovative consortia between universities and business, an approach that does not discourage the figure of the entrepreneur-professor (with clear regulations), and the creation of special institutes for professional refresher courses.

Organizations Involved

It is no secret that there are currently two associations, Anasin-CNTA-Confindustria and Assintel-FTA-Confcommercio, vying for leadership in the software sector and, more generally, in the advanced service sector. There are rather "strong" political designs and strategies behind both these groups. The Confindustria considers that its incorporation of Anasin and the development of the national committee for the advanced service sector as a kind of insurance policy for its postindustrial future. The other pole, not averse to the activities of "modern" politicians like Gianni De Michelis, puts itself forward as an alternative to the traditional Confindustria model. Many entrepreneurs in the sector maintain that, for the purposes of developing an appropriate industrial policy in the software sector, all this is to the good in Italy—provided that the competition over the next few years between the two groups is fair and is played out in the area of services to associate members and of initiatives.

For its part, Anasin is looking at a series of initiatives: the development of a training center in the south, the creation of sectoral study centers and clubs to encourage partnerships and agreements, the formation of telecommunications lobbies, and last, the passage of the long-awaited law for the legal protection of software.

However, there are numerous obstacles to be overcome. The major one is the need for innovative software projects to have complete access to government incentive funds (law 46 and special law 64 for the south of Italy). This is the leading edge of a policy (through the manipulation of public projects) to encourage the formation of groups, centers, and the competive strengthening of the sector.

Table 1—Breakdown of Activities

Type of Activity	Exclusive	Predominant	Total
Traditional processing	11	2	13
Innovative processing	1	1	2
Software products for minicomputers and PC's	2	5	7
Professional services: Development of custom software	5	8	13
Professional services: other	6	2	8
Professional services: mixed	8	7	15
Integrated systems: business applications	0	1	1
Integrated systems: special applications	2	2	4
Hardware sales	0	3	3
Processing plus miscellaneous	24	—	24
Miscellaneous	1	—	1
No reply	1	—	1
Total	69	31	100

Table 2—Total Sales

Sales breakdown (in millions of lire)	1985	1986	1987
0-500	18	14	13
501-1000	14	10	13
1,001-2,000	11	24	13
2,000-5,000	17	19	17

Table 2—Total Sales

Sales breakdown (in millions of lire)	1985	1986	1987
5,001-10,000	9	7	20
10,001-20,000	7	10	7
20,001-50,000	6	5	8
over 50,000	1	3	2
No reply	17	8	7
Total	100	100	100

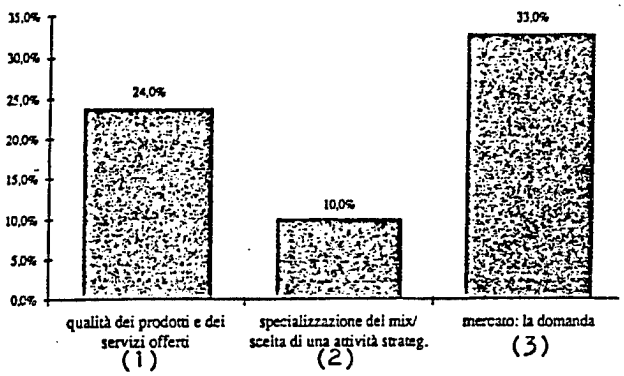

Table 3—Major Development Factors Cited

Key:
1. Quality of products and services offered
2. Choice of right specialization strategic activity
3. Market demand

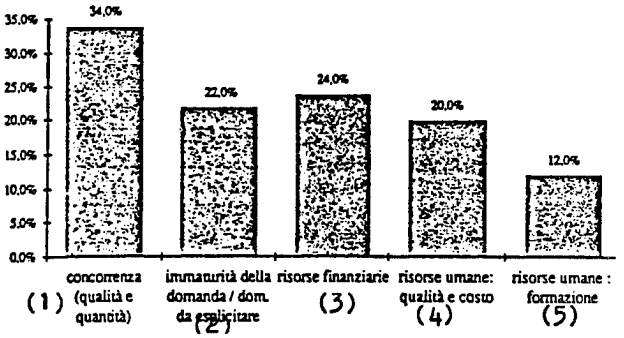

Table 4—Major Development Obstacles Cited

Key:
1. Competition (quality and quantity)
2. Immature or unspecified demand
3. Financing
4. Human resources: quality and cost
5. Human resources: training

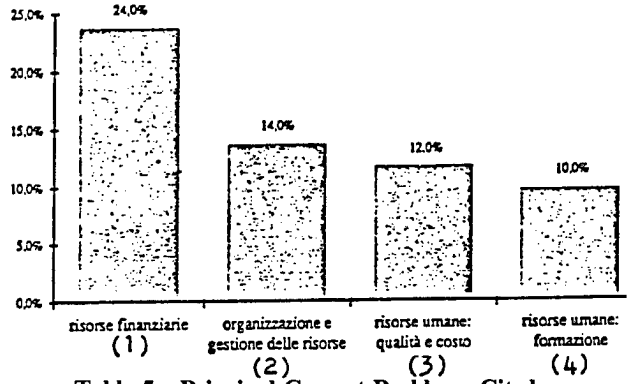

Table 5—Principal Current Problems Cited

Key:
1. Financing
2. Resource organization and management
3. Human resources: quality and cost
4. Human resources: training

Table 6—Geographical Range of Acitivites

Area	Initial	Current	Future Strategy
Local	59	28	14
Regional	21	20	22
Surrounding area	3	9	6
National	13	37	43
International	1	5	10
No reply	3	1	5
Total	100	100	100

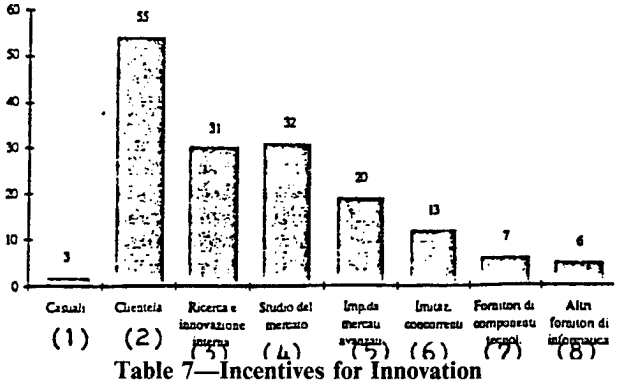

Table 7—Incentives for Innovation

Key:
1. Chance
2. Customers
3. In-house research and development
4. Market studies
5. Incentives from advanced markets
6. Imitation of competition
7. Suppliers of technological components
8. Other computer technology suppliers

Table 8—Projects Underway (42 people interviewed)

Application Sector	Number times Mentioned	Percentage of total interviewed
Horizontal management systems	5	11.9
Management systems for vertical markets	17	40.5
Special application sectors/office automation	1	2.4
Databases	1	2.4
Data communication/telecommunications	7	16.7
Factory production control	3	7.1
CAD/CAE	2	4.8
Industrial automation	2	4.8
Automation systems	—	—
Software development environments	5	11.9
Expert systems/artificial intelligence	5	11.9
Vans	—	—
Other	4	9.5

8615/9738

FACTORY AUTOMATION, ROBOTICS

Survey on European Cooperation in Automated Assembly Systems Outlined

3698m171 Bonn BMFT JOURNAL in German No 6, Dec 87 p 6

[Text] In many areas of industrial production, assembly costs amount to between 20 and 50 percent of the overall production costs, and are rising. The degree of automation in assembly is still low. The assembly is the area with the greatest potential for modernization. Assembly automation demands the integrated application of key technologies such as robotics, computer-aided engineering (CAE), industrial networks, image processing, and artificial intelligence. Flexible assembly automation is the technological challenge facing European production in the 1990's. The competitiveness of European industry depends primarily on an accelerated, future-oriented solution of the assembly problems. European cooperation in this sector is therefore of the utmost importance.

In mid-1986, a preliminary study was initiated to examine the possibilities of European cooperation in the field of flexible automated assembly systems. The FRG, France, Great Britain, Italy , Austria, Sweden, and Spain took part in this study.

This survey is now complete. R&D priorities were determined on the basis of an analysis of the present status of assembly automation and an assessment of the market potential. The study is based on ideas and requirements cited by industrial users and manufacturers of assembly systems, along with research institutes during the course of numerous workshops and discussions. The study deals with the following development priorities:

—**Assembly planning**: This includes assembly-oriented product design as well as conception, projection and design of assembly systems, workplace design, and employee qualifications.

—**Assembly systems**: This includes programming and control of assembly systems, system integration, quality control, and trouble shooting.

—**Assembly technologies**: This section includes handling systems, flexible gripping systems, sensor technology, as well as feeding and assembly technologies.

The results of the study were announced at the EUREKA Conference in mid-September 1987 in Madrid. Initial cooperative projects were also presented at the conference. In order to ensure continuity and to accelerate the cooperation process in the assembly systems sector, the seven participating countries have agreed to establish an information and communication network over a period of 2 years.

08706

BMFT Subsidizes Technology Centers for Industrial CIM

3698m160 Bonn TECHNOLOGIE NACHRICHTEN-MANAGEMENT INFORMATIONEN in German No 469/470, 16 Dec 87 pp 6-7

[Excerpt] Small and medium-sized companies in particular should be allowed to obtain information quickly on the possibilities offered by computer integrated manufacture (CIM). The FRG Minister of Research and Technology has promoted a plan which accelerates the industrial applications of the special know-how [gained by] relevant research institutes, and has provided DM25 million for this purpose.

CIM involves the connection of all operational fields in manufacturing companies through information technology. Attempts are being made to use information technology to gradually link existing and future "automation islands" according to specific operations (for example, in the fields of development and construction, planning and control of manufacture, and process automation in factories). Above all CIM involves the integration of work processes and the creation of new integral work operations. However, forms of organization and management also have to be changed. The complex interrelation between a company's existing organizational structure, the construction of a computer integrated system, and the complementary work organization must be taken into account in CIM planning.

The dissemination of CIM technology has only just begun. With the exception of a few large companies, there is very little experience in this field, nor are employees trained to work in it.

The potential users of CIM should be able to obtain information quickly on the possibilities of this technology. The planned CIM technology exchange focuses on the following tasks:

—Providing general information on the development stage of CIM (for example, development trends, results of research and development, and experience);

—Holding seminars (introductory seminars on important CIM themes, distribution of seminar literature);

—Demonstrating leading CIM solutions (for example, demonstration of basic components for integrated CIM, experiments using CIM instruments and equipment);

—Providing orientation on the fundamental procedures necessary for the preparation of CIM plans (further detailed advice specifically tailored for individual manufacturers will be offered by the relevant commercial companies);

—Organizing meetings to permit exchange of experiences with CIM.

Institutes in the following regions will cooperate in this technology exchange: Aachen, Berlin, Bochum/Dortmund, Braunschweig, Darmstadt, Erlangen, Hamburg, Hannover, Karlsruhe, Munich, Saarbruecken, and Stuttgart. Representation of these areas guarantees an even regional distribution within the FRG. The institutes, which have received subsidies totaling DM25 million from the FRG Minister of Research and Technology, have already started preparatory work, and will begin operations around mid-1988.

08701

MICROELECTRONICS

European ASIC Activities Expanding

ASIC's Becoming European Asset

3698A051 Paris L'USINE NOUVELLE in French 5 Nov 87 p 19

[Article by Claude Amalric: "ASIC's: Europe's New Weapon"; first paragraph is L'USINE NOUVELLE introduction]

[Text] Fast and cheap small-scale production of customized integrated circuits: This cannot be done by major companies but offers small European companies an opportunity to establish a strong presence in a booming market.

If there is one area in which European semiconductor manufacturers can hold their own, it is certainly that of ASIC's (application specific integrated circuits). The recent inauguration of the European Silicon Structures [ES2] plant at Rousset and the birth of the Austrian AMS company a month ago demonstrate Europe's intention to penetrate this new market. The importance of this outlet will be highlighted at the Components Exhibition from 16 through 21 November at Villepinte.

It is certainly worth it. ASIC's already represent some 15 to 20 percent of this year's $25-billion world market in integrated circuits. This amount will be quadrupled in 4 years! Estimated at $700 million in 1986, this market has increased by 22 percent over the current year and should reach $2.3 billion in 1992.

The trade's big names immediately recognized this shift. However, ASIC's mainly involve "silicon service" impossible to perform with their heavy structures. That is why Intel and Motorola set up smaller companies specializing in ASIC's in addition to their large-scale manufacturing, the advantage being that the group's power can always be relied on if the need arises. However, they are less flexible than companies established solely to manufacture ASIC's. This is an opportunity which must not be missed by small companies.

Before merging with Thomson Semiconductors, SGS [General Semiconductors Company] had already moved in this direction by setting up the independently structured IST at Agrate to manufacture ASIC's. The market is definitely not restrictive: "Almost all the 180 to 200 projects carried out in 1987 originated outside the group," says IST manager Piero Martinotti. He manages the subcontracting of large orders to SGS' sideline production facilities. Still too young to be profitable, IST handles small-scale production of military and telecommunications circuits. "We will be out of the red once our monthly sales exceed $1.8 million." IST has reached $1.5 million: It will not be long now.

Even less exposed than IST because it is within Alcatel NV, Mietec (50 percent Alcatel, 50 percent Belgian government) has been in operationsince 1985 using an unusual technology combining digital and analog functions on the same chip. Since the beginning of 1987, Mietec has started to penetrate the free market, where it eventually hopes to realize 40 to 50 percent of its sales. This year's revenues amount to Fr 145 million with a staff of 300 people. Here, too, the break-even point should be reached next year.

The same is true for AMS near Graz in Austria: Fr 190 million in sales this year with a staff of 475 and a 30-percent growth rate expected for next year. No safety net here as AMS stands alone. "Our strength is to do everything—from design to final testing—on the same premises, with no fewer than 26 technologies at our disposal," says Hartwin Bretenbach, marketing director. AMS even has an electron beam machine to produce masks. This is a key point: Some 10 masks are needed to manufacture an IC. This explains ES2's choice at Rousset: The electron beam direct-stepping-on-wafer lithography is an advanced technique, which is especially frightening to its competitors.

Different in structure and technology, yet resulting from the same need, these companies are bound to be successful. All the more so because they are complementary rather than competitive.

Other companies are following in the footsteps of these pioneers: Asic, for instance, a Netherlands start-up created by former Philips staff, which is the only company other than ES2 using function compiling software; or MHS [Matra Harris Semiconductors], which would like to increase its custom circuit sales (currently 25 percent of revenues). This thriving market justifies optimism.

Belgian Mietec Advancing

3698A051 Amsterdam COMPUTERWORLD in Dutch 3 Nov 87 p 3

[Article by J.S.: "Alcatel and SGS/Thomson Agree To Cooperate"; first paragraph is COMPUTERWORLD introduction]

[Text] Brussels/Geneva—Alcatel, the company founded a few months ago by the French CGE [General Electric Company] and the American ITT groups, has signed a commercial and technical cooperation agreement with SGS/Thomson. This Italian-French company is Europe's second largest chip manufacturer.

According to the terms of the agreement, Alcatel will be given access to SGS/Thomson's chip technology. This means that Mietec, a Belgian company from Oudenaarde which is the only chip manufacturer within Alcatel, can now also manufacture components for Alcatel's E-10 telephone exchanges as well as for its minitels. In fact, the agreement stipulates that Mietec may act as a second supplier to the detriment of American competitors. Mietec is a subsidiary of Alcatel Bell Telephone in Antwerp and of the GIMV [Regional Development Company for Flanders].

In addition to SGS/Thomson's CMOS [complementary metal oxide semiconductor] technology, Mietec will also gain access to other technologies of the French-Italian company, which, in exchange for this technology transfer, has obtained the guaranteed supply to Alcatel of its own products. It should be noted, however, that SGS/Thomson did not gain access to Mietec's technology.

Pierre Suard, managing director of Alcatel, expects Mietec will soon increase its sales by 35 million guilders as a result of this chip agreement. This year's sales should reach 55 million guilders. Nevertheless, as yet Mietec is still in the red.

Finally, Suard announced that Alcatel, together with the Finnish company Nokia and West Germany's AEG [General Electric Company], will form a European consortium for the development, manufacture, and sale of mobile telephone exchanges.

25024/06091

New Photolithographic Mask Production Processes in FRG

36980137a Duesseldorf VDI NACHRICHTEN in German 4 Dec 87 p 20

[Article by Ursula Ehrfeld: "Photolithography Is Holding Its Own—VDI/VDE Technical Conference on 'Mask Technology for Microelectronics Components'"]

[Excerpts] The structures of semiconductor components are becoming more and more complex, while the line widths are becoming smaller and smaller.

The required smallness for such structures is not overstraining present-day photolithographic mask technology for the 4-Mbit storage chip. This statement holds true even for the 16-Mbit chip. What benefits the mask manufacturer here is the fact that ever since the 64-kbit DRAM [dynamic random-access memory], the predominant devices being used for the wafer exposure are reducing steppers that operate mostly on a scale of 5:1 or 10:1. This means that the line widths on the enlarged mask—the so-called reticle—are 5 to 10 times larger than the line widths on the chip. Because of the limited image field of the projecting optical system, the mask can contain only a few chip fields, which then are multiplied on the wafer in the "step-and-repeat" process.

Exacting Demands for Defect-Free Materials and Super-Pure Media

The greatest problems in connection with making reticles are caused by the requirement that the reticle field of about 50 cm^2 to 60 cm^2 in size, with its many millions of separate geometries, must be produced absolutely free of defects.

For the generation of submicron masks, the standard procedure for pattern creation is tracing by means of an electron beam. But in addition to this, reticle production by laser also has its champions. Dr R. Wijnaendts-van-Resandt, who presented a laser system developed by Heidelberg Instruments, even sees in this the heralding of a new age in the sector of electronics. The system described by him is based on a powerful argon laser emitting in the ultraviolet range, a high-speed beam deflection system with a polygonal mirror, and precision positioning that is controlled by a laser interferometer. Considerations of economy provide the main arguments for this alternative, which according to the manufacturer should bring considerable cost advantages in comparison to the electron beam tracer.

Absorber Material Can Cause Defects on Masks

Defects on masks or reticles can consist of either extra deposited material or else the lack of absorber material. One talks about dark and bright defects or of "opaque" and "clear defects." Since industrially used photolithographic masks consist of chromium patterns that are 0.06 μm to 0.1 μm thin on substrates made of glass or quartz, the repairing of opaque defects signifies a removal of chromium, whereas clear-defect repairing means an additional applying of chromium or of an absorber with equivalent properties. These tasks can be fulfilled both by suitable laser systems and also by ion beam systems. Both types are available on the market; an ion beam system was presented at the mask conference.

H. Wahlers of Valvo reported on his almost 6 months of experiences with the KLA/Micrion 808, the first of this type in Europe. In connection with opaque field repair, the absorber—that is, chromium, for example—is removed by sputtering material off with a focused ion beam. For clear-field repair, in addition to depositing absorber layers such as chromium, carbon, aluminum, gold, tungsten, and other materials that are introduced into the focus of the ion beam as compounds in vapor form, Micrion offers a second possibility—the engraving of fine scores into the absorber. Such scores, also called "microprisms," act as opaque spots because of light scattering and reflection. Despite all the advantages that this machine has, nevertheless there are evidently still certain shortcomings to complain about. Undesired depositions of the gallium used as the ion-beam medium—called gallium staining—as well as a complicated and thus slow load-lock system were criticized.

A quite different, still relatively new way to generate masks (and accordingly to repair them) has been pursued by the Max-Planck Institute for Nuclear Physics in Heidelberg. Here the transparent carrier and the absorber structure no longer consist of differing materials. Instead, in silicon monocrystal layers that are at first homogeneous and heteroepitactic, with a thickness of 0.1 μm to 1 μm (carrier: sapphire), a selective irradiation with high-energy heavy ions (such as Kr+ or Ga+) brings about crystalline-amorphous phase changes. The crystalline regions remain transparent, while the regions made amorphous become opaque. The silicon mask with an amorphous-crystalline contrast that was described by Dr S. Kalbitzer is restricted to wavelengths above about 400 nm. For shorter wavelengths, a high contrast between amorphous and crystalline phases can be achieved only with a relatively low transmittance. Meanwhile, an intensive search is going on to find suitable materials for the far UV range with good contrast and transmission properties.

The people at the Karlsruhe Nuclear Research Center (KfK) are placing their hopes neither in silicon nor in some of the other mask materials now being discussed and tested, such as silicon nitride, silicon carbide, or the boron nitride strongly favored at times in the United

States. As Dr W. Schelb argued, the contrary requirements for high X- ray transparency and for extreme dimensional stability even after a long irradiation are fulfilled by far the best by beryllium. Because of the high X-ray transparency of beryllium, comparatively thick carrier foils can be made. Jointly with Degussa, the KfK is developing a special PVD process for making beryllium foils, with which initial trial samples have already been made. The primary goal aimed at with this development is to make available X-ray masks for deep X-ray lithography. Masks for semiconductor technology might be a spin-off of these developments.

Photo Caption

p 20. Based on an idea of the Heidelberg Max-Planck Institute for Nuclear Physics, in a joint effort with the Japanese firm of Kyocera and Denka-Factory a wafer mask has been produced whose microstructures have been brought about by selective ion irradiation. Here, high-energy heavy ions cause crystalline-amorphous phase changes in an initially homogeneous silicon layer.

12114

SCIENCE & TECHNOLOGY POLICY

EEC's Budget for Framework Program Itemized

3698A038 Paris LA LETTRE EUROPEENNE DU PROGRES TECHNIQUE in French 2 Oct 87 pp 6-7

[Text] With the 1987-1991 Technological R&D Framework Program being the subject of the Saclay seminar, this LETTRE features an exclusive table insertion of the programs in the new areas of this framework program.

The table's figures are expressed in million ECU [MECU] as approved by the Council. One point must be clarified: To the total of 5,396 million ECU one must add 1,084 million ECU for financing specific programs already approved or under way. A total of 417 million ECU must be set aside at the request of the UK which should clarify its position at the Copenhagen summit next December.

The Research Council, which is meeting as we go to press, should adopt a common position for RACE [R&D in Advanced Communications Technologies in Europe], science and technology at the service of development, and medical research. These three programs could benefit from the emergency procedure at the European Parliament and be approved by the Council of Ministers of 30 November.

Eight more programs (ESPRIT II [European Strategic Program for R&D in Information Technologies], AIM [Advanced Informatics in Medicine], DELTA [Developing European Learning Through Technological Advance], DRIVE [Dedicated Road Infrastructure for Vehicles Safety in Europe], BRITE [Basic Research in Industrial Technologies for Europe], Radioprotection, Fusion, Access to Large Systems) could be decided during the 21 December Council meeting. It should be noted that for ESPRIT and RACE a call for a "declaration of interest" or of "reserve" has already been issued in order to speed up the proposals. Finally, the program of the Joint Research Center and five other programs (Joint Reference Office, Biotechnologies, TAMDA (research on agriculture), FAST [Forecasting and Assessment of Science and Technology], and Science (new version of the stimulation program)) cannot be decided upon during the Danish presidency, but can only be given a first reading at the European Parliament.

Activities Concerning the 1987-1991 Community Framework Program for Technological Research and Development

CONC: concerted project, including COST [European Cooperation in Scientific and Technological Research]
SCP: shared-cost project
JRC: project of the Joint Research Center

	Area and Programs	Type	MECU
1.	Quality of Life		375
1.1.	Health		80
	Medical and public health research	CONC	
1.2.	Radiation protection		34
	Radiation protection	SCP	
	Radiation protection (revision)	SCP	
1.3.	Environment		261
	Environmental protection	JRC	
	Environment, climatology, and major technological risks	SCP-CONC	
	Application of space teledetection techniques	JRC	
	Industrial risk	JRC	
2.	Information Society		2,275
2.1.	Information technology		1,600
	ESPRIT I	SCP	
	ESPRIT II	SCP	
2.2.	Telecommunications		550
	Telecommunications technologies (RACE)	SCP	
2.3.	New services of common interest		125
	DRIVE	SCP	
	DELTA	SCP	
	AIM	SCP	
3.	Modernization of Industrial Sectors		845
3.1.	Science and technology of manufacturing industries		400
	BRITE	SCP	
	BRITE (revision)	SCP	
3.2.	Advanced materials		220
	Materials and structures	JRC	

Activities Concerning the 1987-1991 Community Framework Program for Technological Research and Development

	Advanced materials (EURAM)	SCP	
3.3.	Raw materials and recycling		45
	Raw materials	SCP	
3.4.	Technical standards, methods, and reference materials		180
	EEC reference office	SCP	
	Reference measurements and materials	JRC	
4.	Biological Resources		280
4.1.	Biotechnology		120
	Biotechnology	SCP	
4.2.	Agro-industrial technologies		105
	Foodstuffs—COST 90 bis	CONC	
	Foodstuffs—COST 91 bis	CONC	
4.3.	Agricultural competitiveness		55
	Agricultural research	SCP-CONC	
5.	Energy		1173
5.1.	Nuclear fission		440
	Reactor safety	JRC	
	Storage and handling of radioactive wastes	SCP	
	Handling of radioactive wastes	JRC	
	Guarantee and handling of fission materials	JRC	
	Nuclear fuels and research on actinides	JRC	
	Shutdown of nuclear facilities	SCP	
5.2.	Fusion		611
	Thermonuclear fusion: JET [Joint European Torus] and general program	SCP	
	Technology and safety of fusion	JRC	
5.3.	Non-nuclear energies		122
	Non-nuclear energies	SCP	
	Solar systems test methods	JRC	
	Management of energy in the habitat	JRC	
6.	Science and Technology Aimed at Development		80
	Science and technology aimed at development	SCP	80
7.	Ocean Resources		80
7.1.	Ocean sciences and technologies		50
	Aid to coastal navigation	CONC	
7.2.	Fishing		30
	Research in fishing	SCP	
8.	European Technical and Scientific Cooperation		288
8.1.	Encouragement		180
	Encouragement	SCP	
8.2.	Use of large facilities		30

Activities Concerning the 1987-1991 Community Framework Program for Technological Research and Development

	Access to large systems		
8.3.	Prospects and evaluation		23
	FAST	SCP	
8.4.	Dissemination and application of findings		55
	EUROTRA	SCP	
	Application of R&D findings		
		Total	5,396

25053

EC Efforts To Strengthen Standardization

3698a154 Brussels EC INFORMATION MEMO in English No P-91, 17 Dec 87 pp 1-2

[Article: "Commission Eager To Strengthen Consumer Involvement in the Standardization Process"]

[Text] The scope of consumer involvement in the standardization process is limited, and should be strengthened at national, international and European level. This is the dominant theme of a draft recommendation just transmitted by the Commission to the Council.

Standardization is seen as an essential instrument in clearing the way for the operation of the internal market, and the Commission attaches particular importance to it under the new approach.

Against this background, the Commission is passing an increasing number of mandates to CEN/CENELEC [European Standards Committee/European Committee for Electrotechnical Standardization] which is responsible for standardization at Community level and which draws together delegates from national standards organizations in the Member States to form technical committees and agree on specific standards. The bulk of these representatives are from the industrial sector, and consumer involvement in the process remains marginal.

All Member States have set up national standards organizations. However, only two States have a satisfactory system for involving consumers in the national process.

Nevertheless, standards are supposed to constitute agreed norms offering the consumer clear guarantees of a certain level of safety, quality and performance. Confidence in the standards laid down is crucial for the Community, and consumer involvement in the standardization process is essential in building such confidence.

Requirements for Effective Consumer Involvement

There are a number of factors to be taken into account when planning to involve consumers in the process of standardization at national level:

- Consumers need to be involved in each national standards organization;

- A priority sorting function must be performed among consumer representatives, in order to achieve standards aimed at providing consumers with a greater degree of protection;

- The competent representatives should be nominated by the consumer organizations concerned and should be included in selected technical committees;

- Basic funding must be provided to enable consumers to play this role without loss of earnings.

As regards consumer involvement in standardization at European level, the role of the consumer organizations should be stressed.

Steps must also be taken to ensure that consumers have the status of full members of the national delegations to CEN/CENELEC.

Action Proposed

The Commission will take action to:

- reach agreement with CEN/CENELEC, as well as with the national standardization institutes, on a new way of working. This action envisages improvements in consumer representation in the European standardization process and, in particular, in the effective involvement of consumers in the national delegations participating in European standardization;

- prepare a priority programme of standardization for consumer products in which account is taken of consumer interests.

Italy, FRG, Netherlands Sign Agreements with PRC

Italy Provides Test Equipment for A-5 Fighter

3698m190 Rome FINMECCANICA NOTIZIE in Italian No 10, 31 Oct 87 p 5

[Text] Aeritalia and CATIC (China National Aero-Technology Import and Export Corporation) have signed an agreement under which Finmeccanica [Mechanical Financial Company] will supply a station for interference testing of avionic systems and instrumentation installed onboard the PRC's A-5 fighter, based on the Soviet MIG.

During the last few months Aeritalia had redesigned the entire avionic system of the PRC aircraft. All the new navigation systems are supplied by Italian industry, with Aeritalia as prime contractor, including the computers for navigation and the processing of meteorological data, and the strike systems. The PRC has an air fleet consisting of several hundred A-5's, and the modernization of these aircraft—about 1.5 billion lire per aircraft—opens the way to future collaboration, including a new version of the plane for export.

In addition, CATIC has a contract in progress for the supply of doors for 100 twin-turbopropeller ATR 42's, of which the PRC airline CAAC is expected to purchase a certain number of units. Finally, the CAAC has another agreement in progress with Alfa Romeo Avio for the reconditioning by Aeritalia of the B 737, B 747, and MD 80 engines, a contract from which the Naples company should get work worth approximately 150 billion lire over 10 years, and which may be extended to include other engines also.

08707

FRG to Build, Launch Satellite in PRC

3698m161 Bonn TECHNOLOGIE NACHRICHTEN-MANAGEMENT INFORMATIONEN in German No 469/470, 16 Dec 87 p 6

[Text] The governments of the FRG and the PRC intend to construct a joint research satellite and to launch it into space from China. This is expressed in a memorandum of intent regarding FRG-PRC cooperation in space research, signed in Beijing. As reported by a spokesman of the FRG Embassy in Beijing, plans have been made concerning the development, joint construction, and transportation of a satellite for biotechnological [tasks]. The cost of approximately $20 million is to be equally shared by the two partners.

08701

Siemens-PRC Joint Venture

3698a115 Paris ZERO UN INFORMATIQUE in French 7 Dec 87 p 6

[Text] As part of a cooperation agreement signed in 1985, Siemens and the People's Republic of China have defined the broad outline of their cooperation. The agreement provides for the creation of a joint-venture for the assembly of digital telephone exchanges, microelectronics technology transfer by the West German company, and the construction in Beijing of a technology center for the training of 500 Chinese technicians per year in areas of Siemens' expertise.

25063

Philips Grants PABX License

3698a131 Amsterdam COMPUTABLE in Dutch 28 Dec 87 p 16

[Article by Yvette Cramer: "China To Manufacture Philips PABX Under License"]

[Text] Eindhoven—Philips recently concluded license agreements with two Chinese plants for the manufacture of Sopho-S corporate switchboards (PABX) [private automatic branch exchange]. The agreement worth 150 to 200 million guilders involves not only the license for the digital, ISDN-compatible Sopho-S switchboard but also the supply by Philips of know-how capital goods, parts, and training.

In addition to the agreements with the Zhen Hua and Changde plants, Philips expects to sign a similar agreement with a third plant by the end of January. Every year, China wants to install 10 times 100,000 lines—some 10,000 switchboards—which will require the establishment of 10 corporate switchboard manufacturing plants. Two of those have now signed an agreement with Philips. The PABX's will primarily be intended for the domestic market, since the Chinese Government wants to curb PABX imports as much as possible in view of its major catch-up drive in the field of telecommunications. It is not known yet whether China will market the equipment manufactured under license elsewhere in the Far East. Last year Americans, Japanese, and European manufacturers fought hard to curry the favor of the Chinese Ministries of the Electronics Industry, Post and Telecommunications, as well as other authorities.

25024

France Increases 1988 Research Funding, Activities

Priority R&D Topics

36980080 Paris LE MONDE Supplement entitled INNOVATIONS 87 in French Nov 87 pp 6-7

[Article by Maurice Arvonny: "French Research Lacks Manpower"]

[Excerpts] Eleven national research programs have just been started by Jacques Valade. But the French lag in money and in manpower cannot be made up.

The minister for research and higher education, Jacques Valade, announced that he was setting up eleven domestic research programs. Since March 1986, no clearly stated scientific policy has been defined.

[Excerpted by editor] For 1988 he has obtained 150 new research positions—while none was contemplated initially. This figure remains, however, well below what would be needed to prepare for the future. The manpower of the other staffs, by comparison, will decrease for the second straight year. Of course, measures are taken to facilitate the transfer of public sector researchers to private enterprises: the ANVAR [National Agency for the Implementation of Research] will offer to the PME [small and medium-size enterprises] 150,000 francs for each researcher hired and organizations such as the CNRS [National Center for Scientific Research] will pay a full year of salary to those of its researchers who will dare to transfer. It is not possible, however, to expect that these measures will result in a substantial movement toward industrial research. The fact is that the latter is not very active in France. The report of the CSRT [High Council on Research and Technology] on the employment of scientists, published in February 1986, indicates that there were 3.7 researchers per thousand working scientists, against 4.7 in the Federal Republic of Germany, 6.2 in the United States, and 6.9 in Japan. French research lacks manpower.

Eleven Priorities

National Programs	Research Priority Actions
1. Biotechnologies	—Microbiological engineering
	—Enzyme engineering
	—Biotechnological engineering
2. Food	—Food sources
	—Processing of agricultural products
	—Nutrition
3. Medical Research	—AIDS retrovirus
	—Ageing and neurological disorders
	—Human genome
	—Medicine, macromolecular pharmacology
	—Biological and medical engineering
4. Human and Social Sciences	—The European living space
	—The national community
	—Man and changes: technology, employment, work
5. Technology and Production	—Mechanics - optics
	—Computer-integrated manufacturing - robotics
	—Creation of products - design
	—Ergonomics and productivity
	—Electrical engineering
6. Electronics and Information Science	—Advanced microelectronics
	Data processing
7. Research on Planning and Trans~~s~~portation	Land transportation
	—Civil engineering
	—Urban engineering and housing (accommodation)
8. Natural Resources and Environment	—Living resources
	—Development of mineral resources
	—Environment
9. New Materials	—Change in standard materials
	Composites

Eleven Priorities

	Ceramics
	Superconductors
10. New Chemistry	—Molecular engineering
11. Research-Development	

The eleven domestic programs accepted by Jacques Valade are listed in the above table and, for each one, the priority items on which effort will be concentrated. The research fund—930 million Francs in 1988—will be set aside to finance research projects related to these programs. The intention of the minister, however, is to encourage the research organizations that report to him, and which he defines as "means or objectives agencies," to direct their manpower and monetary resources along the same lines.

Many actions are a continuation of earlier efforts, but there are some innovations, such as the action of the New Materials program which involves the new superconductors for which funds in the amount of Fr20 million were allocated starting in 1987. The minister considers this New Materials program of great importance. Other actions to which the minister attaches great importance are research on AIDS and on European living space.

For certain actions, such as that on land transportation, not in original operations, it is specified that no attempt is made to duplicate the work carried out by specialized agencies, but rather to initiate more basic studies whose results will help applied research. Each program will be endowed with a scientific committee consisting of researchers and manufacturers, which will draft competitive bids, advise the minister, evaluate the results. The minister insists on the fact that there should be no automatic renewal and that each program must be limited in time.

13415/9274

Overall R&D Budget Figures

3698A085 Paris L'USINE NOUVELLE (PUBLI SPECIAL supplement) in French 19 Nov 87 pp III, V-VI

[Article: "Research and Innovation: Future Is Well in Hand as 1987 Marks a Turning Point"; first paragraph is L'USINE NOUVELLE introduction]

[Excerpts] 1987 will have been the year of great declarations; 1988 should be the one of great developments.

Early this year the prime minister and the minister of research and higher education, Jacques Valade, announced ambitious government objectives. "Research is vital to our future," Jacques Chirac stated in January 1987 on a visit to a molecular genetics laboratory in Alsace; "it deserves to be better understood and supported.... Our economic development and expansion depend on it." Affirming that research must be a national priority in 1988, the government thus decided to step up tax incentives and financial aid to small- and medium-sized companies.

Research by French companies currently represents 1.2 percent of the gross domestic product [GDP], compared to 1.7 percent in Japan and 1.9 percent in the United States and the FRG. France is most certainly still lagging behind its OECD partners. Indeed the share of R&D funding by industry is estimated at 43 percent in France, 50 percent in the United States, and 58 percent in the FRG.

The gap widened in 1978. In 1970 French companies had expenditure levels virtually equal to those of Germany and Japan. At that time only the United States was already well in the lead. The French lag is evaluated at 0.5 percentage point today, which represents at least Fr 25 billion.

Government policy in favor of industrial innovation and research has obviously been less developed in France than in the other industrialized countries. Nevertheless, the general picture is far from being as bleak as might be believed. Among OECD countries, France allocates the largest budget share to R&D. The state's contribution amounts to 1.40 percent of GDP, or a little more than 6 percent of the general budget.

Considering that public funding (as a percentage of GDP) equals 0.53 percent in Japan, 1.14 percent in the FRG, and 1.18 percent in the United States, the role of the public authorities in this sector can be better appreciated, especially since funding has been further increased.

Fr 70 billion was devoted to research in 1987. The draft 1988 budget earmarks almost Fr 89 billion to civilian and military R&D, Jacques Valade announced when presenting his ministry's budget on 22 September, emphasizing that it is "a budget that clearly reflects the priority which Jacques Chirac's government has decided to give research."

This year's overall growth rate is between 8.5 and 10.5 percent.

Fr 55 billion of the planned Fr 89 billion will go to civilian public research, i.e., Fr 6 billion more than in 1987. This budget increase for 1988 will make it possible, among other things, to create 150 jobs in government research organizations, including 100 new positions at the CNRS (National Center for Scientific Research), 25 at INSERM (National Institute for Health

and Medical Research), 16 at INRA (National Institute for Agronomic Research), and 9 more at ORSTOM (Overseas Scientific and Technological Research Organization).

Increasing from Fr 750 million in 1987 to Fr 930 million in 1988, the Research and Technology Fund's [FRT] budget will make it possible to turn toward cooperative projects involving research organizations and companies. These will certainly not be the first experiences: Last March, CNRS signed an agreement with Rhone-Poulenc to create a joint laboratory to study heterogeneous catalytic reactions, in addition to their joint laboratory in Montpellier for new material research created 1 year earlier (in cooperation with the Science and Technology University), and the one near Lyons for basic physiology studies.

This close cooperation with business makes it possible to implement an efficient research policy which quite often results in patent registrations. This is the case with CNRS and also with INSERM, which forms associations with pharmaceutical firms or subsidiaries of foreign companies. These two examples among many others illustrate the dynamism of this "formula."

In 1985 13,512 patents were registered by residents—20 times fewer than in Japan (274,398 patents registered by residents) and almost 5 times fewer than in the United States (63,874). In return, patents registered in France by nonresidents are definitely more numerous, being in excess of 42,000. Should we believe that the French seriously lack inventive imagination or resources and agree to being invaded by foreigners? Not quite, according to the INPI (National Institute for Industrial Property). In fact, INPI officials stress, the French unfortunately do not have the "patent reflex." And it is not uncommon for French companies to be "robbed" of inventions for lack of protection.

It is also characteristic that the ratio of patents of national origin to the total patents registered is lower in France than anywhere else: 22.2 percent in France compared to 29.4 percent in the UK, 43.2 percent in the FRG, 52 percent in the United States, and 83 percent in Japan.

Despite these not always flattering figures, the INPI is relatively optimistic because it recorded a 7.3-percent increase between 1985 and 1986 in the total number of patents registered, representing an 0.8-percent increase in the number of domestic patents against a 15.5-percent decrease in the number of foreign patents.

To affirm its support to research and innovation, the government also declared that the 1988 ANVAR (National Agency for Research Implementation) budget would be increased. Almost Fr 1 billion will be made available to this public organization in charge of implementing scientific and technological research findings. ANVAR, which decides on financial aid and follows innovative projects and programs, has already supported more than 8,000 French companies since 1979. In addition, it administers a portfolio of 2,400 patents. It plays an essential role in preparing and launching new products.

In order to define project funding and plans for industrial implementation, ANVAR joins with various financial establishments. For example, it recently signed agreements with Banque Nationale de Paris (and its business and consulting subsidiary, Banexi) and the Chambre Syndicale des Banques Populaires [Popular Banks Federation].

The Credit Lyonnais, the Caisse Centrale de Credit Cooperatif [Central Fund for Cooperative Credit], the Banque Vernes et Commerciale, Banque de Bretagne [Bank of Brittany], and Caisse Nationale du Credit Agricole [National Fund for Agricultural Credit] are some of the estalishments which bet on the future by adhering to the "Aid to Launch Innovation" convention.

High technology funding poses real problems of language and radically different practices between bankers and scientists. A bank, by nature, generally thinks in terms of known calculated risks. A scientist trying to prove the full significance of sequencing Escherichia coli desoxyribonucleic acid [DNA] plunges the banker into a disturbing unknown.

For this reason, in 1985 the then minister of research, Hubert Curien, urged the creation at the Societe Lyonnaise de Banque [Lyons Banking Corporation] of a science department headed by a high-level researcher, Francois Juillet.

At a time when banks seem to have decided on developing their role in the research field, venture capital or start-up capital appears a promising new opportunity for fledgling companies badly in need of funds. This new financial activity is not yet well known by the public, but it should come into widespread use by the business world in the future.

This encounter between entrepreneurs and owners of equity capital should enable small- and medium-sized firms to find the necessary development funds. There are already many examples of venture capital funding in France: On 26 June 1987 ANVAR signed its first agreement with a venture capital finance company called Innovest.

The agreement provides that "the two partners shall undertake to inform each other of technological innovation projects and requirements for equity capital provided that the company concerned agrees, as well as of projects for the creation of technology enterprises."

Country	By Residents Ratio/GDP		By Non-residents	Nonresidents/ Residents Ratio
France	13,512	19.1	42,602	3.15
United States	63,874	20.5	117,006	1.83
FRG	39,625	44.5	43,478	1.10
UK	20,044	36.8	48,138	2.18
Japan	274,398	209.0	30.997	0.11

Table 1. Number of Patents Registered in France in 1985 (Source: INPI)

Country	1984	1985
France	36,493	36,546
United States	147,794	149,920
FRG	90,951	93,829
UK	35,622	37,522
Japan	63,213	74,447

Table 2. Number of Patents Registered Abroad (Source: OMPI [World Organization of Intellectual Property])

The popular banks, for their part, claim to have developed regional venture capital resources designed to provide small- and medium-sized companies with the necessary funds to complete their various innovation projects.

Beside the conventional sources of public and private funding, numerous original solutions have recently been proposed. Among these, an initiative deserving special emphasis because of its innovative aspect: an FCP [Joint Investment Fund] to help companies set up by officials of the Nancy-Brabois "technopole," the Sagittaire group, and the SNVB [Company for Industrial Credit of Nancy and Varin-Bernier], a bank of the CIC [Industrial and Commercial Credit Bank] group.

[Caption 1] Statistics compiled by the Ministry of Industry, PTT, and Tourism: "Indicators of Competitiveness," 1987.

[Caption 2] Registering patents is not a French custom! Fortunately it is not the only indicator of innovation. Table 3 shows that France is doing fairly well in the field of intangible investment; however, France is known to invest more willingly than others in theoretical research and less in industrial research.

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Country	1974	1976	1978	1980	1982	1984
France	2.25	2.4	2.6	2.85	3.2	3.35
United States	4.3	4.4	4.5	4.9	5.7	6
FRG	2.35	2.6	2.7	3.15	3.4	3.55
UK	3.1	2.9	3.2	3.3	3.5	3.8
Japan	2.35	2.4	2.4	2.5	2.8	3.15

*Intangible investment comprises training, R&D, patents, software, and marketing expenditures.

Table 3. 1974-1984 Development of Intangible Investment* as a Percentage of GDP (Source: Credit National)

France Finalizes 1988 Budget for Research, Technology Fund

36980187 Paris INDUSTRIES ET TECHNIQUES in French 10 Feb 88 p 21

[Article by Michel Alberganti: "Fr930 Million for the Research and Technology Fund"]

[Text] Eleven national programs, including 33 priority projects, will receive Fr 400 million.The Research and Technology Fund (FRT) was allocated a total of Fr930 million for 1988. Following a strong reduction in 1986, due to "the reorganization of public finance," it was strengthened in 1987 (Fr750 million) and increased this year by 24 percent. It contributes to research and technology in four ways: training industrial cadres through research (Cifre agreements, Fr160 million); financing part of the Fr800-million French participation in the Eureka program (Fr200 million); supporting regional projects (Fr120 million); and finally financing 11 national programs (Fr400 million). The latter are designed as "a set of priority research projects lasting 3 to 5 years and expected to lead to industrial technological developments." For the MRES (Ministry of Research and Higher Education) which manages them, the national programs will also provide, higher up, a boost to key sectors. And a succession of spinoffs are expected. Behind this credo, we find a determination to ensure coherence in research efforts in order to complement the efforts made, higher up and in all directions, by the ANVAR [National Agency for the Implementation of Research].

70 Percent of the FRT Earmarked for the Industry

It remains to be seen whether the amounts set on each program are adequate to achieve significant progress. Each national program is the responsibility of a scientific committee in charge of preliminary studies, invitations to bid, the examination and selection of research projects, and the implementation of the projects adopted. The highly competent scientific experts which sit on these committees are assisted by executive secretaries. Among the scientific committee chairmen, we find renowned manufacturers such as Pierre Aigrain (Thomson), Jean Lagasse (Renault), Gilles Pomey (Usinor-Sacilor) and Gaston Sifre (Peugeot). According to the MRES, 70 percent of the FRT is earmarked for the industry, the goal being to develop cooperative research. Except for Fr13 million, the Fr400 million allocated to national programs are currently divided among 11 programs and 30 priority projects. But that does not mean that these funds are spent. Manufacturers interested can apply with the ministry. On the average, the FRT finances 33 percent of the programs. The remainder is contributed by the manufacturers themselves (at least 50 percent) and by organizations such as the ANVAR or the AFME [French Energy Management Agency]. This year, the MRES wishes to spend all of the FRT funds earmarked for national programs during the first half of the year. This would represent a 6-month gain over last year. It is up to manufacturers to take advantage of this haste, which may not be entirely accidental...

FRT 1988 Budget: +24 Percent Over 1987

Category	Percentage	Amount (Million Francs)
National Programs	43	400
Participation in the Eureka Program	21.5	200
Training	17.2	160
Regional Programs	13	120
Miscellaneous	5.3	50
Total	100	930

The 11 National Programs of the FRT for 1988

New Priorities: Computer Integrated Manufacturing and New Materials

National Programs	Priority Research Projects	1988 FRT Budget (Million Francs)
Biotechnologies	Microbiological engineering; enzymatic engineering; biotechnological engineering	21
Foodstuffs	Food sources; agricultural product processing; nutrition	40
Medicine	Retrovirus: AIDS; aging and neurological handicaps; human genome; medicines and molecular pharmacology; biological and medical engineering	50
Human and social sciences	The European space; the national community; Man and technological mutations	15
Technology, computer-integrated manufacturing	Mechanics, optics; computer-integrated manufacturing, robotics; product design; ergonomics and productivity; electrical engineering	70
Electronics, data processing	Advanced microelectronics; data processing	80

The 11 National Programs of the FRT for 1988

New Priorities: Computer Integrated Manufacturing and New Materials

National Programs	Priority Research Projects	1988 FRT Budget (Million Francs)
National and regional development and transportation	Surface transportation; civil engineering	19
Natural resources	Living resources; forestry; development of mineral resources	9
New materials	Traditional materials undergoing a mutation; composites; ceramics; superconductors	60
New chemistry	Molecular engineering	13
Development-oriented research	Environment and resources; growth; mobility; socio-economic concentration phenomena; food production	10
Credits not yet allocated		13
Total		400

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France Announces 1988 CNRS Budget

36980145 Paris AFP SCIENCES in French 26 Nov 87 pp 1-6

[Article: "Research Policy and Organization"]

[Text] The CNRS [National Center for Scientific Research]: Over Fr9 billion.

Despite a "rather tight budget" which forced it "to make choices," the CNRS, the largest French research organization, which 18 months ago seemed about to be broken up, has set ambitious objectives for itself in 1988, according to its general manager, Mr Serge Feneuille. It has overcome the long malaise that affected it in 1987 and, "back on its tracks, it is now in a position to operate normally."

On 23 November, at his first national press conference since he took up his post on 4 June 1988, Mr Feneuille stated that with Fr9,088.9 million, i.e. 2.1 percent more than in 1987, in other words with "a courageous budget at a difficult time, I am confident that the scientific community will make the efforts required to preserve to the utmost our lead over foreign organizations."

The Budget

Of these Fr9,088.9 million, Fr6,753 million represent operating expenses, including Fr5,698.5 million for personnel expenditures, still the largest budget item. True, next year the CNRS will employ 10,760 researchers, including 270 newly hired, about 100 of whom will get the 100 posts recently created; and 14,972 engineers, technicians and administrative employees (ITA) after 226 job cancellations and 150 job creations, in particular at the Scientific and Technical Documentation Center (CDST) in Nancy.

Program authorizations amount to Fr2,202 million, payment appropriations to Fr2,131 million; state subsidies: operating expenses and program authorizations together amount to Fr8,955.5 million; operating expenses and payment appropriations amount to Fr8,884.5 million. The organizations own resources amount to Fr133.4 million (see Table 1).

Table 1 - 1988 Budget: CNRS and Institutes

	In Millions of Francs	1988/1987
Title III - Operating expenses	6,753.5	1.8 percent
incl. Personnel expenditures	5,698.5	1.7 percent
Title VI		
- Program authorizations	2,202.0	1.0 percent
- Payment appropriations	2,131.0	2.9 percent
Total state subsidies		
- Operating expenses + program Authorizations	8,955.5	1.6 percent
- Operating expenses + payment appropriations	8,884.5	2.1 percent
Organization's own resources*	133.4	-
Total budget (operating expenses + program authorizations	9.088.9	2.1 percent

* Expected revenues and amounts drawn from the working capital.

Next year's breakdown of resources among the scientific departments will be as follows:

Life sciences	25.54
Chemistry	16.07
Human and social sciences	13.81
Mathematics, basic physics	11.91
Sciences of the universe	11.76
Nuclear physics and physics of particles	11.61
Physical sciences for the engineer	9.30

(See also Table 2 for a break down in millions of francs.)

Table 2 - Breakdown of 1988 Resources Among Scientific Departments

In Millions of Francs	Total Budget	Minus Personnel Expenditures
Nuclear physics and physics of particles	797	328
Mathematics, basic physics	817	220
Physical sciences for the engineer	638	155
Chemistry	1,102	240
Sciences of the universe	807	252
Life sciences	1,752	398
Human and social sciences	947	122

The Objectives

The priority objective is to attract the young to research by creating each year 200 engineering doctorate grants and allocating Fr10 million to another 40 grants reserved to the sectors of chemistry and physical sciences for the engineer; these are co-financed with businesses, regional organizations, etc. An innovation in this respect in France: the co-financing of (Fr5 million) of about 20 two-year post-doctoral grants.

The second objective is to ensure that the laboratories are competitive by making sure that their equipment is as good as that of their foreign competitors, but to slow down on major equipment purchases except for commitments already made at national and especially international level. There would be no reduction of the amounts allocated for the Strasbourg vivitron (Fr19.4 million), the Grenoble European synchrotron (ESRF) (Fr45.5 million), and the European very large telescope (VLT) that will be located in Chile (Fr6 million).

Among new projects: an additional Fr8 million for in-depth research on superconductors, the subject of the 1987 Nobel prize for physics; another Fr5 million also for data processing; Fr13 million to create two plant biology and pharmacology-biotechnology laboratories; Fr2 million to support human and social sciences research libraries (see Table 3).

Table 3 - New Programs Included in the 1988 Budget

	Amount
Superconductors	Fr8 million
Applications of high-energy lasers and creation of a laboratory	Fr2 million
Specific program in the field of data processing	Fr5 million
Equipment of the IN2P3 laboratories with CAE-CAD stations	Fr2 million
Synthetic-aperture programs (preparation of the VLT)	Fr6 million
New programs in oceanography (FRONTAL) and the earth sciences	Fr4 million
Furnishings and equipment for the Plant Sciences Institute (GIF), and pharmacology-biotechnology program in Sophia-Antipolis	Fr13 million
Outfitting the protein crystallography equipment with two- dimensional detectors	Fr4 million
Support for human and social sciences research libraries	Fr2 million
Mid-weight equipment for archaeologists and oceanographers (Fr1 million) and launching of new human and social sciences research programs (Fr1.5 million)	Fr2.5 million
Co-financing of engineering doctoral grants, jointly with the industry	Fr10 million
Co-financing of post-doctoral grants	Fr5 million

To develop partnerships with businesses—the third objective—the CNRS is planning to create 50 joint laboratories in the next 5 years. Eight have already been created; another two will soon be announced: one with SEP (European Propulsion Company) in Bordeaux (composite materials); and another with Bio-Mrieux in Lyon-Gerland (biochemistry and macromolecular biochemistry).

Other scientific groups will be added to the 50 or so which now exist— including 20 for chemistry. To promote relations between its laboratories and small or medium-size businesses (the PMI), the CNRS makes its researchers available; next year in Nancy, it will also create the National Institute for Scientific and Technical Information which, through a commercial subsidiary, should become a "large consulting office" selling its services to the PMI.

Fr96.6 million of the budget allocations are earmarked for construction projects in Lyon-Gerland, Bordeaux, Grenoble, Orsay, Nanterre, Marne-la- Valle, Meudon and Bellevue (see Table 4). The largest of these, that of Marne-la-Valle, involves the creation of a high-energy

physics laboratory at Cit Descartes, in cooperation with the College of France and the Paris-6, Paris-7 and Paris-12 Universities. This will be a 10,000-m^2 building where high-energy applications will be studied, especially in advanced technological fields such as data processing, CAD, etc. It will benefit, among other things, from the proximity of the Bull Company training center. A total of Fr80-100 million will be allocated to it over 3 years.

Table 4 - Principal 1988 Construction Projects

	Amount
Protein engineering in Lyon-Gerland, and appropriations to study the feasibility of a molecular genetics center in Montpellier	Fr9.0 million
Participation, jointly with SEP, in the creation of a laboratory in Bordeaux	Fr2.0 million
Extension of the Grenoble vegetal macromolecule research center (CERMAV)	Fr2.5 million
Continued construction of the Orsay space laboratory	Fr4.7 million
Study of the creation of a human and social sciences laboratory, jointly with the Paris-10 Nanterre University	Fr2.0 million
Financing of the Marne-la-Valle project	Fr19.0 million
Refurnishing the premises that will house all "communication products" of the DIST in Meudon-Bellevue	Fr7.0 million

According to Mr Feneuille, "it was advisable to create some competition in this field in the Paris area, where we already have the LAL. I am confident that the area east of Paris will possess a large scientific center within 10 years; remember the criticisms that were made when the issue was the creation of the Orsay laboratory, and yet today everybody is happy with it."

The cooperation that started already a few years ago between the Directorate of Research and Technical Studies (DRET) and the General Delegation to Armament (DGA) will continue with the creation of a joint laboratory. Open to any other partner besides the DRET, the Fontenay laboratory will study materials processing with very-high-energy lasers. It should make possible different approaches to these devices.

"This does not mean that the CNRS is selling out to the devil. It is still playing its part, which is to increase knowledge through basic research, and researchers will still be able to publish, but more or less in the long term and after full consultation," Mr Feneuille pointed out. "There is a 1980 decree on publications dealing with fusion, and its implementation has never been a problem. (...) Besides, we encounter the same problems when we cooperate with the industry."

Interdisciplinary Research Programs

As far as interdisciplinary research programs (PIR) are concerned, the general manager of the CNRS seems to be in favor of a "pause." Apart from PIRMAT (PIR on materials)—which received a 41-percent increase— all programs will see a 15-percent decrease in their budget. And no new programs will be started.

"We must take time to think, to evaluate these programs. After its evaluation, PIRSEM [PIR on energy and raw materials] will continue, but with a reduced budget. PIRMAT will in turn be the subject of an evaluation led by the chief executive officer of a large French company, and we shall go on with studies of this type. We might have started a PIR on biotechnology, but no decision has been made yet." (See Table 5 for the amounts appropriated.)

Table 5 - Interdisciplinary Research Programs

PIRSEM	(Energy and raw materials)	Fr13.5 million
PIREN	(Environment)	Fr7.6 million
PIRMAT	(Materials)	Fr19.6 million
PIRTTEM	(Technology, jobs, employment and life styles)	Fr3.1 million

Looking ahead to the unified European market of 1992, the CNRS policy is innovative in one respect: the launching of joint laboratory projects with the FRG, and in particular with the Max Planck Institute. But other countries, especially the United States, are not excluded. "I strongly believe in regional, scientific and technical poles, the Rhine Basin, the Midi-Pyrenees-Catalonia area," Mr Feneuille stated.

In his opinion, it is impossible that British teams should exclude themselves, for budget reasons, from projects such as the Grenoble synchrotron. They are among the leaders in the fields of crystallography and biology. "It would be difficult to accept that British participation be that of a smaller country. Even if they do not join right away, we must complete this project," the CNRS general manager insisted, "for they will come back; they cannot stay away."

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